

MACHINES AND APPLIANCES IN GOVERNMENT OFFICES

Revised Edition

PUBLISHED FOR H.M. TREASURY
ORGANISATION AND METHODS DIVISION
BY H.M. STATIONERY OFFICE

1954

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Preface

GOVERNMENT DEPARTMENTS in this country use the simpler types of office machinery, such as adding and calculating machines, freely in all branches;

addressing machines extensively, organised where possible as a common service;

more than 1800 accounting and book-keeping machines;

more than 300 photographic and photo-copying installations employing all the accepted processes of photographic reproduction;

more than 80 punched card installations, notably on census tabulations, medical and personnel statistics, meteorological analyses, accounting, stock recording and control, covering the full range of such machines;

over 300 million punched cards in a year.

AS A RESULT quicker and more effective service is given and much laborious hand work is obviated.

THIS BOOK is designed to demonstrate within the Government service the advantages to be gained by developing the use of office machines. It may be of wider interest, but experience of their working and capacities and operating speeds in Government Departments must not be taken as a judgment on their performance in other conditions.

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SOME OF THE MACHINES AND APPLIANCES IN THE MACHINE DEMONSTRATION ROOM AT H.M. TREASURY



THE INFORMATION RECORD AT H.M. TREASURY COMPRISING FILES OF SUPPLYING COMPANIES LITERATURE INDEXED BOTH BY SUBJECT AND ALPHABETICALLY. FACTUAL DESCRIPTIONS OF THE VARIOUS MACHINES AND APPLIANCES ARE RECORDED IN LOOSE LEAF BINDERS

Introduction

THE OBJECT OF THIS PAPER is to give an account of machines and appliances in Government offices in terms of the kind of work for which each is suitable. Details of construction and working have been left out unless they serve this purpose. Thus the paper is not an encyclopedia of machinery, nor will it provide a ready-made solution to any problem of mechanisation arising in a Government office. Its greatest value may be to suggest possibilities of mechanisation in fields where it may not always be obvious that there is scope for it. A wider knowledge should quicken the process of bringing every modern device to bear on the complex administrative tasks of the day. [1]

Every effort has been made to write simply, but a description of quite straightforward mechanical operations, however lucidly written, can easily fail to put over the essence of what a machine can do. On the other hand an actual demonstration, though it may give a clear understanding at the time, is apt to become blurred in memory and will be less effective to the extent that

the student is distracted by having to take notes of detailed performance. The best results are to be got from the conjunction of both methods, and this paper is most likely to succeed in its purpose if it is regarded as complementary to the Treasury's training courses in organisation and methods. [2]

The opening section deals with preliminaries to the installation of machinery, merely running over the main points to be remembered when proposals are under consideration. In the great variety of circumstances these questions cannot be settled without informed advice, given after close examination of the facts of each case. A Department can seek help from its own O. & M. Branch, if there is one, or from the Treasury O. & M. Division, where an exhaustive index of office machinery is maintained by a staff of specialists who are able to keep abreast of current developments. The frequency of changes is an added reason why machines are not here described in detail. [3]

General Considerations

REVIEW OF PROCEDURE

Not all problems of office methods are to be solved by the installation of office machines. Mechanisation is sometimes advocated to relieve situations in which the real trouble comes from procedural refinements that have accumulated in the course of years. Methods may need to be pruned rather than mechanised. It may be found that some simpler machine than was first contemplated will meet the case or that there is no need for a machine at all. [4]

No scheme of mechanisation should therefore be put in hand until the existing procedure has been thoroughly overhauled. But a mere examination of how the job is now being done will not be enough: the investigator must establish what are the basic requirements of the job and whether the job could be cut out altogether if changes were made elsewhere. Only then should he go on to consider ways and means; to settle whether the purpose will best be served by alternative manual methods, or by machine methods or by a combination of both. Well designed forms and the simplest equipment will often do better than elaborate machinery. [5]

PROS AND CONS OF MECHANISATION

Mechanisation may give one or more of the following economies*

- (a) greater speed;
- (b) less effort;
- (c) closer control of accuracy;
- (d) improved legibility of records;
- (e) more extensive use of available information;
- (f) more information for management control.

On the other side there is the cost of the machine itself and of any special stationery that may be necessary. Furthermore mechanisation can sometimes be bought only at the price of too high a degree of specialisation. [6]

POOLING OF EQUIPMENT

In varying measure office machines can usefully be pooled to provide a common service. A balance must be struck between the well-known drawbacks of centralisation and the following advantages:—

- (a) machines more likely to be fully employed;

* Economy is here used in its widest sense to include not merely saving in cost but also improvements of service which could not otherwise be secured without greater cost.

- (b) greater volume of work, possibly justifying the installation of a better model, e.g., power-operated instead of hand model;
- (c) more opportunity of using special types of machines for special types of work;
- (d) greater variety of work, enabling operators to be the more ready to deal with unusual jobs;
- (e) better facilities for supervising staff and for noting their skill and making the best use of it.

[7]

STANDARDISATION OF EQUIPMENT

With machines such as duplicators, addressing machines, and punched card equipment, it is usually best to keep to the products of one manufacturer. The main advantages of doing so are :—

- (a) training of operators is simpler;
- (b) peak loads of work may be spread over all machines;
- (c) breakdown of machines or absence of an operator has a less serious effect on the output of the pool;
- (d) only one type of consumables and accessories need be carried; and
- (e) all machines may be attended to by one mechanic at one visit.

[8]

But standardisation should not be carried to the point where the relative merits of the products of several manufacturers are ignored. Furthermore, it may sometimes be worth while to install an odd machine for a particular type of work.

[9]

CHOICE OF MACHINE

Most types of equipment are made by two or more manufacturers, each manufacturer providing models with features exclusive to his own product. It is usually possible, once the type of equipment has been decided upon, to examine the products of several manufacturers before selecting the make and model best suited to the purpose in view.

[10]

Selection should be guided by :—

- (a) comparison of the relative merits of the products of all manufacturers;
- (b) simplicity and ease of operation of the machine;
- (c) relative machine speeds;
- (d) construction, i.e., durability and likely freedom from breakdown; and
- (e) cost, including cost of consumables.

[11]

TRAINING OF OPERATORS

The number of machines required and the speed at which the work is done will depend to a large extent on

the skill and accuracy of operators. Staff must be well trained if the best is to be got out of the machines. The success or failure of a mechanised procedure may depend on training.

[12]

The period of training varies according to the type of machine and the quality of the staff.

[13]

All manufacturers of office machines provide facilities for training operators on their own machines and most firms have provincial as well as London training centres.

[14]

Some Departments have set up training schools of their own in which new operators are trained on certain types of machines, and this method is working well.

[15]

LAY-OUT AND ACCOMMODATION

When a procedure is divided into processes carried out in sequence, equipment should be so arranged in the rooms that the work flows in one direction with no backward movements. For example, in a duplicating room, the stencil should be received at one end of the room, where it is rolled-off on the machine. The copies should be passed to the collating tables and then on to despatch with a minimum of movements between operations and no criss-cross movements to cause obstruction to easy flow of work.

[16]

As much of the work on machines will usually be reading and recording, operators should work in natural light, wherever possible. Machines should be placed so that the operators are able to read without difficulty both the media from which information is taken and the entries recorded by the machine. Sufficient space should be allowed for the machine and for the forms and documents so that the operator can work in comfort. Suitable furniture should be provided, including tables and chairs at the proper height for easy movements. There should also be suitable cabinets, racking, etc., for storing stationery and supplies.

[17]

STATIONERY AND SUPPLIES

When forms are specially designed for use with machines, close attention should be paid to printing limits and other limitations imposed by the machine (see O. & M. paper—"The Design of Forms").

[18]

Forms must be printed and delivered several days before a changeover to machine work takes place. Otherwise the operators will not have time to familiarise themselves with the processes before getting to work. Consumable items, such as ink, ribbons and carbons, and equipment such as cabinets and trays should of course, be ordered in good time.

[19]

Classes of Machines and Appliances

Machines and appliances are classified in this paper as follows:—

- (a) Writing and reproducing
- (b) Adding and calculating
- (c) Accounting
- (d) Punched card systems
- (e) Classifying, indexing and filing

- (f) Sorting, collating and selecting
- (g) Miscellaneous.

This arrangement is primarily based on the type of work for which the equipment is used, subject to the important exception that punched card systems cover several types of work. When a machine has a primary and a secondary purpose and might therefore appear under more than one heading, it is described under the heading appropriate to the primary purpose. [20]

WRITING AND REPRODUCING

There are many processes and machines available for writing and reproducing, and in deciding which to employ the following factors should be considered:—

- (a) the condition and contents of the original documents from which copies are to be made;
- (b) the number of copies required;
- (c) whether the master will need to be revived at a later date to make more copies;
- (d) permanence of copies;
- (e) the quality and appearance desired in the copies (paper, ink, type-face, colour, etc.);
- (f) whether hairline registration is necessary when matter is to be reproduced on printed forms or in two or more colours; and
- (g) cost of reproduction.

A guide to processes of reproduction suitable in various conditions is given in the illustration overleaf. [21]

The process to be employed will often be determined by the type of machine installed in the Department, but it should be noted that H.M. Stationery Office have central and regional reproducing pools which are equipped to undertake many types of reproduction. They also have in London a co-ordinating officer who will arrange for all types of work to be done which Departments themselves are unable to undertake. [22]

MANIFOLD REGISTERS

Manifold registers facilitate the manuscript preparation of a form with several carbon copies. The register is designed to use interfold or roll-type continuous stationery. The stationery may be interleaved with one-time carbon paper or may pass between sheets of carbon paper at the writing position. [23]

The maximum number of forms in one set for use in a register is normally six. [24]

In the operation of the register, the first set of forms is brought to the writing position when the register is loaded. When the entries have been made, the first set of forms is ejected and the next set is brought to the writing position by the movement of a crank. [25]

With some registers a security copy of the form can be retained in a locked compartment. Other models may be fitted with a till and used as cash registers. [26]

The main benefits gained from using manifold registers are:

- (a) the several forms in the set are brought to the writing position in accurate alignment;
- (b) a firm and hard writing surface is provided;
- (c) handling is made easy and time is saved because there is no interleaving and removal of carbons; and
- (d) if required, a security copy can be automatically locked away. [27]

Small portable manifold registers, with certain limitations in the features provided, are also available. [28]

TYPEWRITERS

The features of the standard typewriter and its uses are generally well known, but the following points are worth noting:

- (a) the standard line spacing is $\frac{1}{6}$ th inch, although other spacings may be obtained by the use of special fittings;
- (b) horizontal spacing on most machines is either 10 to the inch (pica type) or 12 to the inch (elite type);
- (c) a tabulating key is provided to facilitate right-to-left carriage movement from one pre-determined position to another; and
- (d) there is a limit to the typing width and this varies in different makes of machine. [29]

REPRODUCTION CHART

FOR MAKING ONE TO 10,000 COPIES (EXCLUDING THE TYPEWRITER) *

BASIC REPRODUCTION PROBLEMS

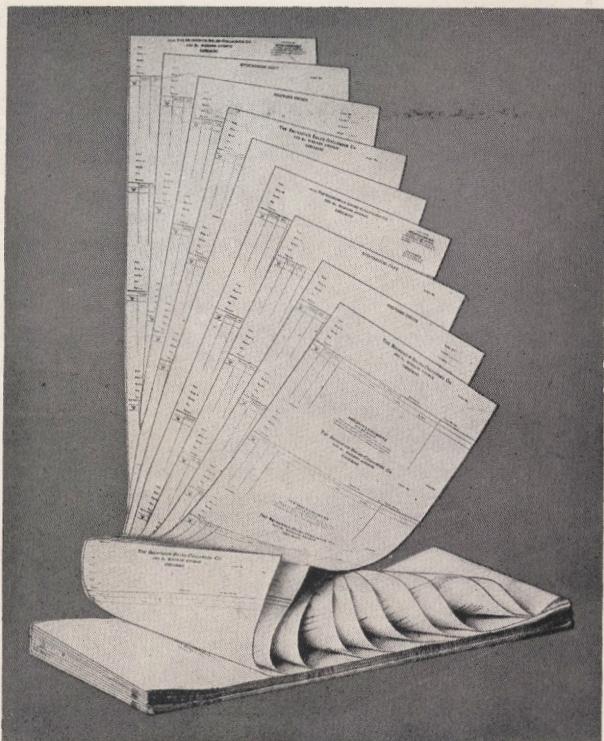
- A Reproduction of an opaque original document without half tones (Facsimile)
- B Reproduction of text without half tones (Non facsimile)
- C Reproduction of an original containing text and half tones
- D Reproduction of an original photograph (Continuous tone)
- E Reproduction of line drawings
- F Enlarged or reduced reproduction of an original document
- G Recording variable data on pre-printed forms or masters
- H Reproduction of selected data from a master
- I Reproduction in two or more colours
- J Durable image
- K Reproduction of documents on translucent material
- L Reproduction on paper with a writing surface

P —indicates that the process can be used (Practical)
 SC—indicates that the process can be used in special circumstances
 IM—indicates that the process can be used with the aid of an intermediary master

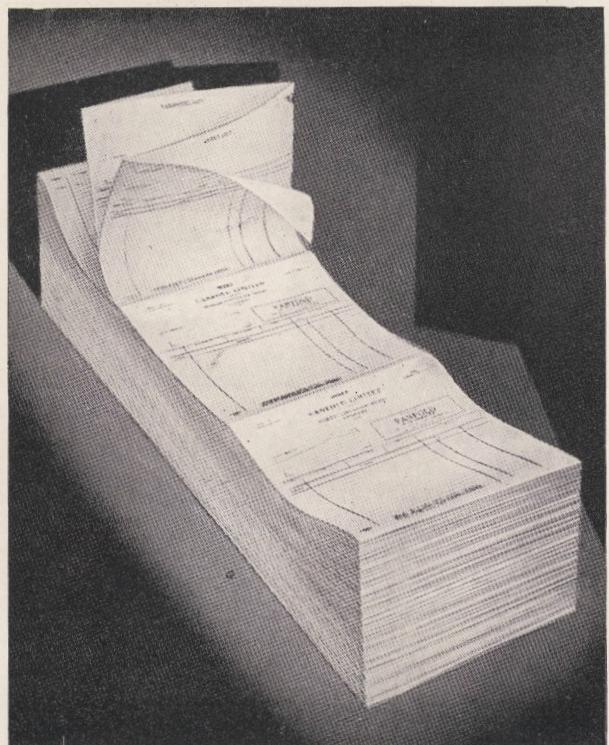
LEGEND

	REPRODUCTION PROBLEMS												NUMBER OF COPIES							
	A	B	C	D	E	F	G	H	I	J	K	L	5	10	20	50	100	500	1000	over 10000
I HECROGRAPHY													P	P	SC	SC	P	P	SC	SC
i Standard Machines													P	P	P	P	P	P	P	
ii Line Selector																				
II STENCIL													IM	P	IM	IM	P	IM	SC	SC
i Written—Typed—Drawn													IM	P	IM	IM	IM	P	P	P
ii Sensitized														P	P	P	P	P	P	P
III OFFSET (Plastic) Plate													IM	P	IM	IM	IM	P	P	P
i Written—Typed—Drawn														P	P	P	P	P	P	P
ii Sensitized														P	P	P	P	P	P	P
OFFSET (Metal) Plate														P	P	P	P	P	P	P
i Direct Typing or Drawing														P	P	P	P	P	P	P
ii Stencil Transfer														P	P	P	P	P	P	P
iii Diapositive Stencil														P	P	P	P	P	P	P
iv Photographic Master														P	P	P	P	P	P	P
IV TYPESET													P	IM	IM	IM	SC	P	P	P
i With Inking Mechanism														P	P	P	P	P	P	P
ii Ribbon Printing														P	P	P	P	P	P	P
V PHOTOCOPYING													P	SC	P	IM	IM	P	SC	P
i Reflex Contact Printing (Silver)														P	P	P	P	P	P	P
ii Reflex Master and Diazo														P	P	P	P	P	P	P
iii Dylene—Blue Print														P	P	P	P	P	P	P
iv Auto Positive														P	P	P	P	P	P	P
v True to Scale														P	P	P	P	P	P	P
VI CAMERA													P	SC	SC	P	P	P	P	P
i Photostat														P	P	P	P	P	P	P
ii Microfilm														P	P	P	P	P	P	P
16-35 mm.														P	P	P	P	P	P	P
Micro Sheet (7.5 x 12.5 c.m.)														P	P	P	P	P	P	P
iii Plan Copy (including 70 mm.)														P	P	P	P	P	P	P
VII ADDRESSING													P	P	SC	SC	P	P	P	P
i Plate														P	P	P	P	P	P	P
ii Stencil														P	P	P	P	P	P	P

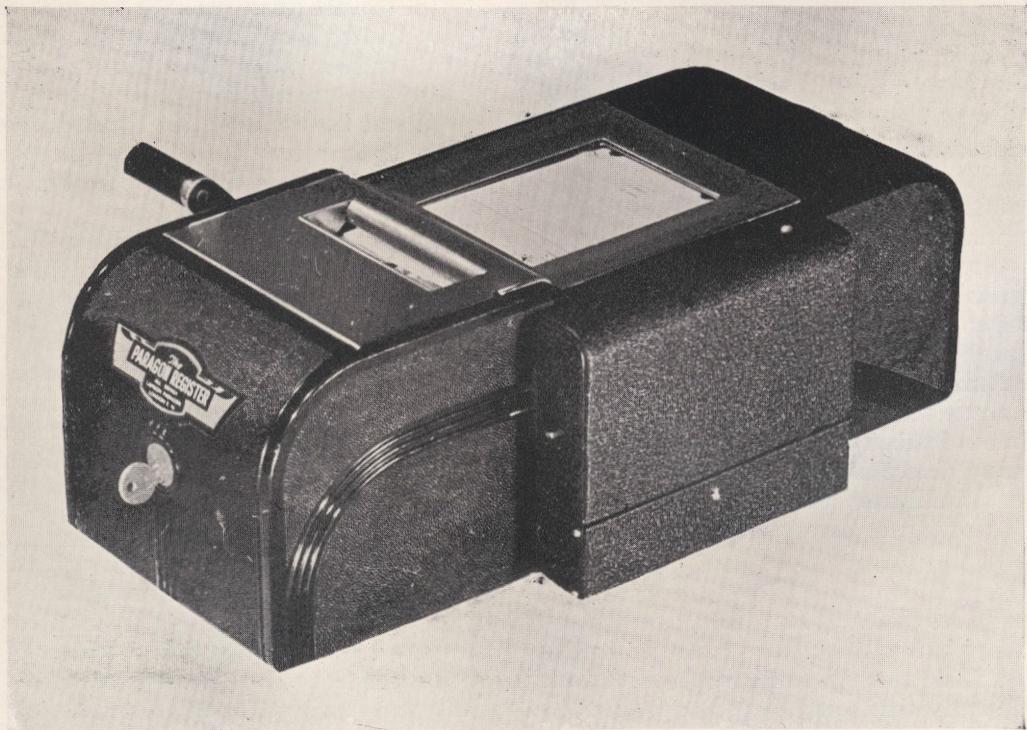
* In normal times it is considered to be reproduced economically for over 10,000 copies to be reproduced by microfilm.



CONTINUOUS INTERFOLD STATIONERY



CONTINUOUS FANFOLD STATIONERY



MANIFOLD REGISTER

FRONT FEED TYPEWRITERS

A front-feed typewriter is commonly used when a line of entries is to be made on two or more forms by carbon copying but the line spacing on one or more of the forms differs from that on the others. Typical examples of typing work suitable for this class of machine are:—

- (a) payable orders and Paymaster General's schedules;
- (b) cheques, cash sheets and posting slips; and
- (c) receipts, cash sheets and bank paying-in slips.

In all these examples the line entries made on the unit documents in the front feed will be scheduled on a form in the rear feed. [30]

The carriage of the machine is provided with a feed at the front of the platen so that the unit documents, in individual or continuous form, can be inserted and extracted without disturbing a summary form held around the platen in the ordinary way. All machines are fitted with a guide to assist alignment between the unit document and the summary form. Some machines are fitted with a chute to facilitate the insertion of individual documents. [31]

CONTINUOUS STATIONERY TYPEWRITERS OR ATTACHMENTS

Continuous stationery typewriters and continuous stationery attachments for standard typewriters are used for the preparation of sets of forms with several carbon copies. [32]

The continuous stationery device may be built into the typewriter as an integral part of the machine or it may be a separate attachment which can be used in conjunction with any standard typewriter. It consists of a carrier over which the sets of forms are drawn, and a fitting known as a carbon head, to which is attached the desired number of sheets of carbon paper. To set up the machine, the carbon paper is interleaved between each of the forms in the first set, which is then drawn round the platen to the typing position. When the first set of forms has been typed the platen is raised or the paper grips released and the carbon paper retracted into the next set of forms. The completed set of forms is then torn off leaving the next set in the typing position. [33]

Many continuous stationery machines are fitted with a type face which prints ten characters to the inch in capitals only. This must be remembered when forms are being designed for use on these machines. Some machines incorporate decimal tabulation, automatic carriage opening, and a keyset tabulator. [34]

The advantages of these machines or attachments are:—

- (a) time lost in handling the forms is reduced because there is no interleaving and withdrawal of carbon paper, and because the forms are fed continuously to the typing position; and
- (b) the forms making up the set are fed to the typing position in accurate alignment. [35]

The continuous fanfold, inter-fold or roll-type stationery used with these machines usually costs more than separate forms or padded stationery. [36]

FLAT-BED TYPEWRITER

The flat-bed typewriter differs from the standard machine in that:—

- (a) the platen consists of a flat, horizontal bed at the base of the machine, and
- (b) the platen remains stationary while the typing head moves backwards and forwards across the work.

The platen is fitted with a paper grip operated by a foot pedal leaving the hands free for aligning the forms. This type of machine is now usually electrically operated. [37]

The advantages of this machine are:—

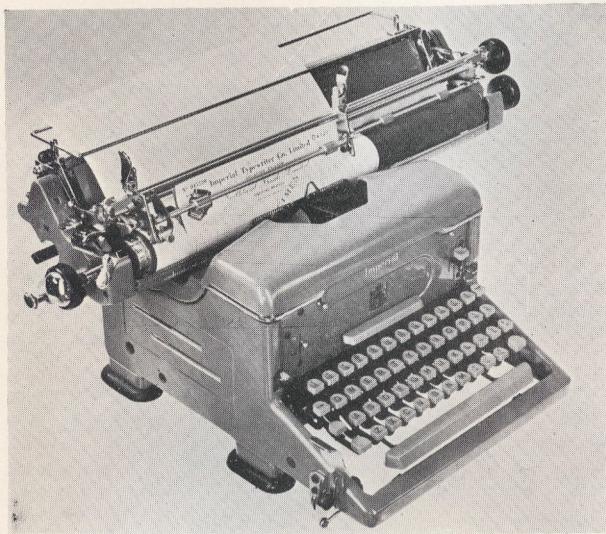
- (a) the downward strike of the type bars on to a perfectly flat platen should produce clearer carbon copies than can be obtained on a standard machine;
- (b) the flat platen permits the feeding of cards and folders as well as paper and the accurate alignment of forms which differ considerably in shape and size;
- (c) in some models it is possible to feed continuous forms or paper from any edge of the platen. [38]

ELECTRIC CARRIAGE RETURN

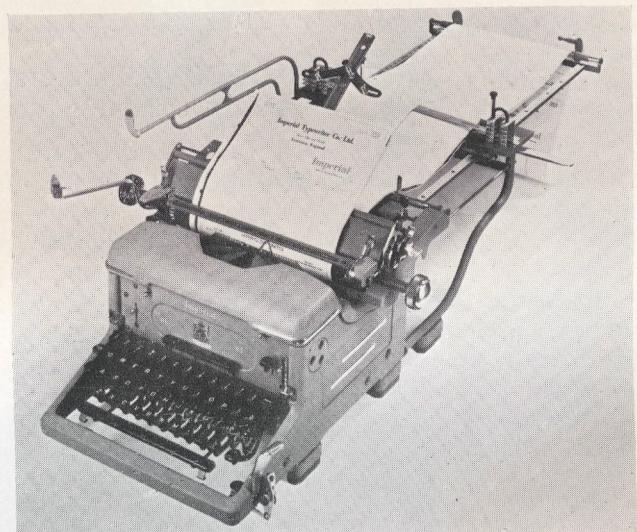
Typewriters may be fitted with an electric carriage return which causes the carriage to return automatically to a predetermined typing position and to space vertically to the next line. [39]

ELECTRIC TYPEWRITERS

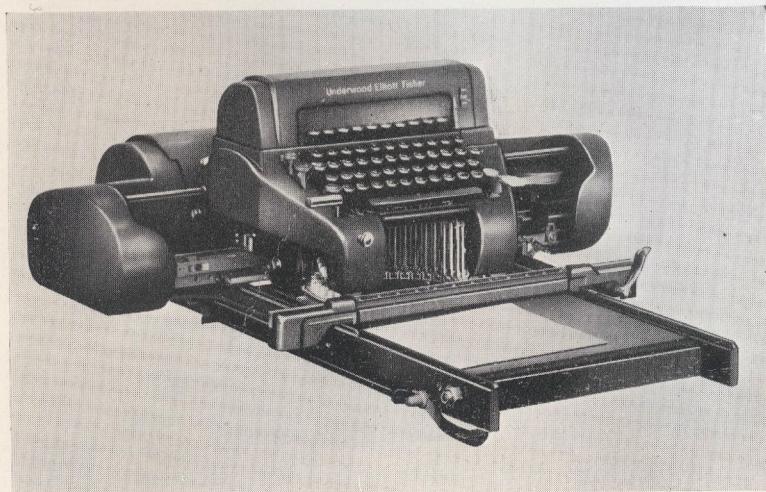
The moving parts of electric typewriters are all driven electrically, and manual typing movements are confined to operating the keyboard. The typist needs apply only a light touch to the keyboard. Evenness of impression is obtained throughout because the force with which the type bar strikes the paper depends not on touch but on the electrical mechanism. The force of strike may be adjusted to suit the type of work. [40]



FRONT FEED TYPEWRITER WITH
SPECIAL SHUTTLE



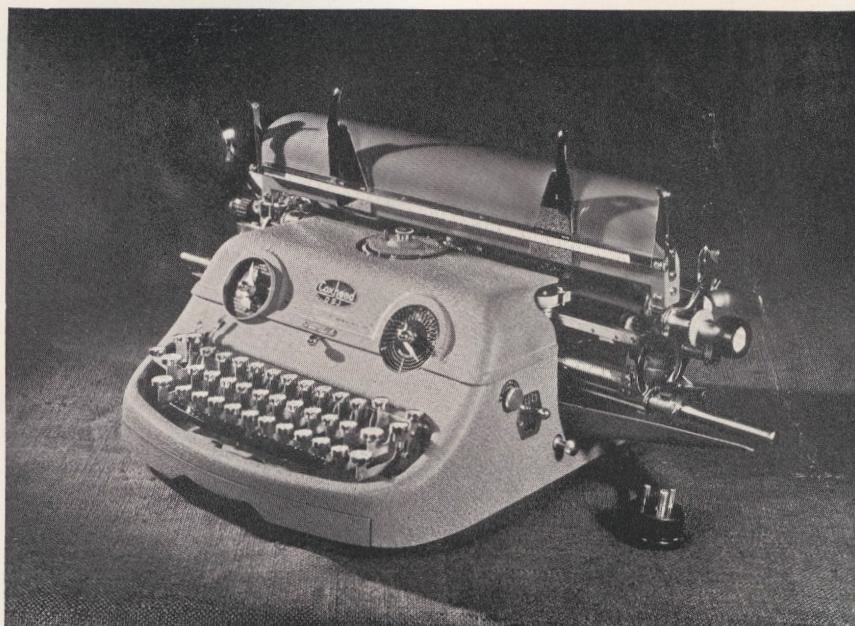
FANFOLD TYPEWRITER
(BILLING MACHINE)



FLAT BED TYPEWRITER

180 Petite Gothic	Since the League of Nations Opium Commission opened its annual session at Geneva a week ago various aspects of the infamous traffic in narcotic drugs have been under discussion; and yesterday the members heard the testimony of RUSSELL PASHA to whose remarkable work in attacking the evil reference has been made in -
158 Miniature Roman	despatches from the Correspondent of THE DAILY TELEGRAPH in Cairo. This British officer, who is Commandant of the Cairo City Police, was appointed early last year Director of the Central Narcotics Bureau, the setting up of which was among the invaluable measures of practical reform which Egypt owes to the late Ministry of MAHMOUD PASHA. The Director's first
211 Miniature Italic	<i>annual report, of which a summary appears in THE DAILY TELEGRAPH this morning, was already before the commission. It is a striking record of service done with energy and keen enthusiasm in laying bare the ghastly facts of the drug-traffic in a country which, in recent years, has become</i>
26 Small Roman	one of the principal sources whence the enormous profits of these exploiters of human weakness are drawn. Since the war, a community in which no more than a small amount of hashish was formerly consumed has
68 Small Italic	<i>turned in rapidly increasing numbers first to cocaine and then to heroin; and it is estimated roughly by the Director that in a population of 14,000,000 there</i>
27 GOTHIC SMALL CAPS LARGE CAPS	ARE TO-DAY SOME 500,000 ADDICTS, FOUND LARGELY AMONG THE STURDY PEASANT STOCK, ON WHOM THE COUNTRY'S PROSPERITY IS BUILT. RUSSELL PASHA, WHILE CARRYING ON AN UNFLAGGING WARFARE AGAINST THE EVIL AND ITS DASTARDLY PROMOTERS ON EGYPTIAN SOIL, HAS
40 Medium Roman	made it his principal object to trace the poison to its foreign origins, to bring to light the secret organisation of the trade, and to enlist the aid of

PART OF THE RANGE OF VARIYPER TYPE FACES



THE "VARIYPER"

The benefits to be derived from the use of these electric machines are:—

- (a) evenness of typing throughout particularly in the preparation of masters for reproduction;
- (b) production of 15 to 20 copies at one typing; and
- (c) ease of operation by the typist.

Other models of electric typewriters are designed to give:—

- (a) proportional spacing (i.e. each letter is given an amount of space according to its construction as in typesetting);
- (b) justification of line (i.e. to produce a straight right hand edge as in typeset).

VARI-TYPER

One drawback of the standard typewriter, compared with the printing press, is that any one machine is limited to type of fixed style and size. The Vari-typer resolves the difficulty in that it is provided with readily detachable type. There is a normal key-board but the type instead of being distributed to separate hammers, is cast on a small semi-circular band of metal. Depression of a key brings the appropriate character into place and then causes it to be struck, through paper and ribbon, by a hammer. The band of type can be withdrawn quickly and replaced by another. One alternative set of type can be brought into action without stopping the machine. Spacing can be readily adjusted, both vertically and horizontally, to suit the size of type in use. It will be seen that the system allows not merely variations in type face but also the use of foreign alphabets and mathematical or scientific symbols. These machines are electric and therefore have the additional advantages described in paragraph 41 above. But they are slightly slower than the standard typewriter and expensive, and it is uneconomical to install them except where there is a substantial volume of work requiring the special treatment for which they cater.

[43]

DUPLICATING AND OFFICE PRINTING MACHINES

Duplicating processes are divided into four groups.

- (a) Hectograph spirit.
- (b) Stencil.
- (c) Offset litho.
- (d) Type-set.

[44]

HECTOGRAPH SPIRIT DUPLICATORS

The master copy is made by writing, drawing or typing on a sheet of art or semi-art paper, the back of which is in contact with a sheet of hectograph carbon

paper or a hectograph carbon ribbon. A hectographic carbon deposit is left on the back of the master corresponding with the entries on the front.

[45]

The duplicating machine is normally of the rotary type in which the master is fitted round the drum. The rolling off paper is first moistened by contact with a dampened pad or roller fed with spirit from a special container. It is then pressed against the master so that a carbon deposit is transferred to the rolling off paper.

[46]

Machines are available with hand or automatic paper feed and also with automatic master change.

[47]

The number of copies obtainable from one master depends to a large extent on the quality of carbon paper or ribbon used to make the master and on the fluid used in the machine. The hectographic dye on the copies tends to fade if kept in strong light. The process is therefore suitable when up to 200 copies are required (although under favourable conditions more copies can be obtained) and when permanence of image is not important.

[48]

Carbon papers of different colours may be used for different entries on one master. Multi-coloured copies can thus be obtained at one printing.

[49]

There are special machines available on which it is possible to reproduce selected lines of entries from the master. These machines are often used when all the entries on the master are required on some copies, but only some of the entries are required on other copies.

[50]

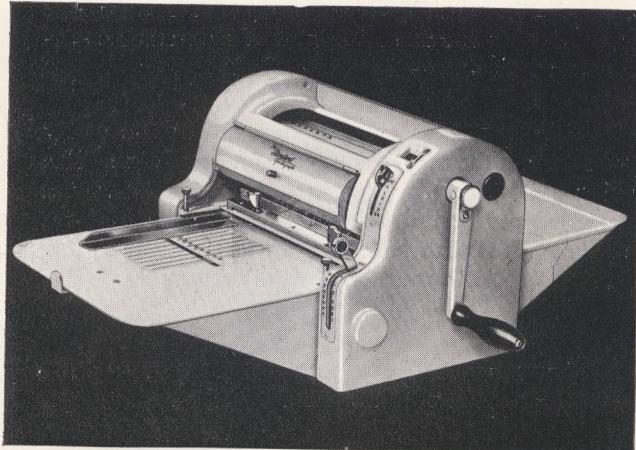
STENCIL DUPLICATORS

In stencil duplicating, the master consists of a fibrous tissue with a cellulose coating or, in the case of a photographic stencil, a gelatine composition making it impervious to ink. Entries are made by typing, drawing, writing, or photographic means, causing the coating of the stencil to be broken to allow the passage of ink. The duplicating process consists of forcing ink through the stencil at the points where entries have been made, so that a copy of the entries on the master is produced on the rolling-off paper.

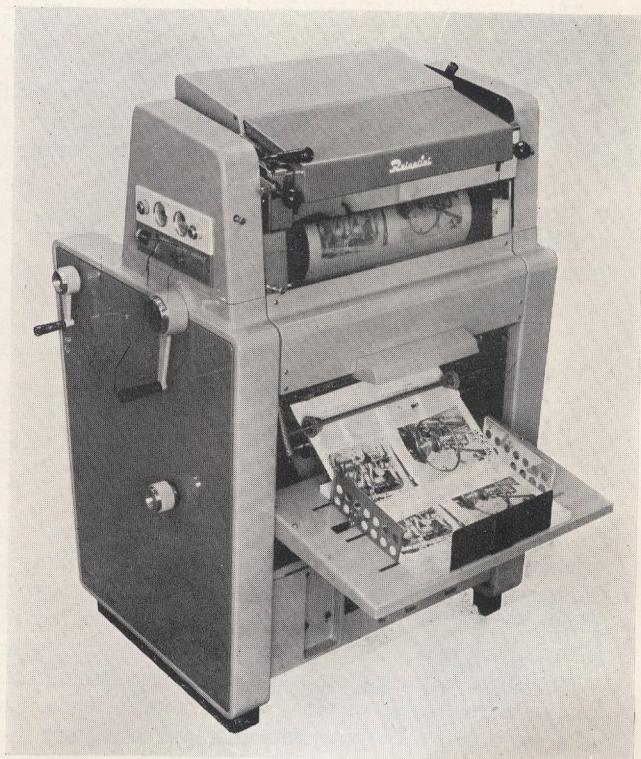
[51]

There are two types of stencil duplicator, flat bed and rotary. The flat bed machine consists of a printing frame to hold the stencil, which may rise automatically after each impression, a flat bed to which rolling-off paper is fed by hand, an inking tablet and an inking roller. The machine is intended for small jobs and for special duplicating such as reproduction on cards.

[52]



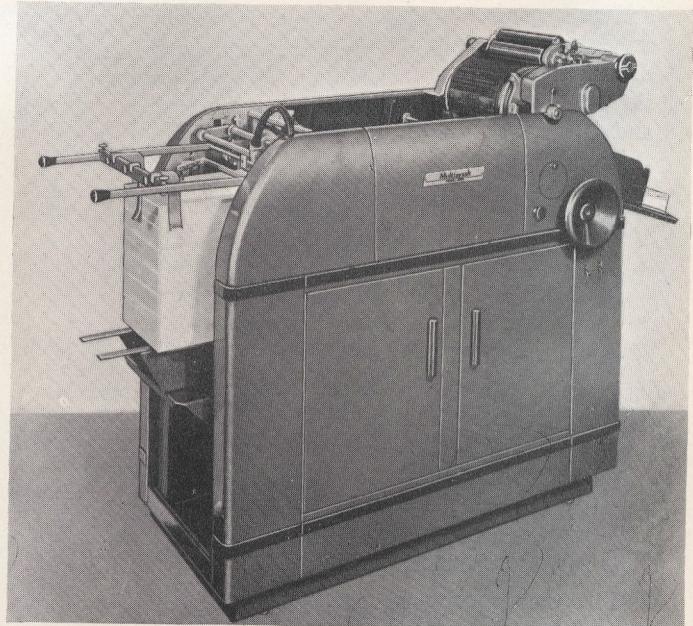
SPIRIT DUPLICATOR



OFFSET LITHO DUPLICATOR



STENCIL DUPLICATOR



TYPESET DUPLICATOR

The rotary machine, which may be hand operated or power driven, consists of a rotary cylinder or cylinders to which the stencil is affixed, inking and pressure rollers, an automatic paper feed and a receiving tray. Some machines are fitted with a device to record the number of copies duplicated and to stop the machine when a required number has been reached. The inking mechanism, which may be semi-automatic or automatic in operation, provides an even distribution of ink over the whole area of the stencil. [53]

A special type of stencil is available for cutting with printers type. The stencils are supplied ready-cut (pre-cut) by the duplicating machine companies and are suitable for the constant headings and rulings of statistical returns prepared at regular intervals and for forms and letter headings for which a display type face is needed. [54]

Stencil masters may also be produced photographically using light sensitive masters. The original document must have opaque lines and letters on a translucent material. The master and original are placed together in a contact frame and exposed to a strong light. After developing, conditioning and drying, the film is used as a stencil on a standard duplicating machine for rolling-off copies in the normal way. [55]

A modification of this process has recently been made available by the introduction of apparatus consisting of a fixed focus camera with a lighting unit and copyholder. This can be used to make photostencils from a variety of originals and eliminate the intermediate step necessary when copying opaque material. [56]

Electronic stencil cutting machines are also available. These machines consist of two cylindrical drums round one of which is placed a document to be copied and round the other a special stencil. The original document is scanned by a light beam and the stencil cut thermoelectrically in accordance with the impulses received from the scanner. [57]

These processes can be recommended for the reproduction of line drawings and technical and scientific data, all difficult work for the typist, when no other suitable photographic equipment is available. Also half-tone reproduction is obtainable from stencils cut by electronic means. [58]

The number of copies which can be obtained from one stencil varies with the quality of the stencil used and the skill in typing and subsequent handling. The process can be recommended when up to 5,000 permanent copies are required and offset litho machines are not available. [59]

OFFSET LITHO

The master from which copies are made by offset litho reproduction is a thin flexible plate of either metal, paper or plastic. [60]

The metal plate may be prepared by the following methods :—

- (a) Typing direct on to the plate through a litho ribbon or litho carbon paper.
- (b) Writing or drawing direct on the plate with pencil and ink, ball pen, crayon or brush.
- (c) Cutting a stencil as for stencil duplicating and inking through the stencil on to the plate.
- (d) Photographic process, using either a diapositive stencil or photographic master. The diapositive stencil is cut as for stencil duplicating, and the photographic master, a negative on film, plate, or paper is made by a camera or by one of the many photo-copying processes. To transfer the image to the plate, the stencil or photographic master is held in contact with a sensitised litho plate and exposed to an arc or similar powerful light source.
- (e) True-to-scale process, whereby the image is transferred to the plate from the true-to-scale table (see paragraph 80). [61]

The paper and plastic plates are normally supplied for direct typing. Pre-sensitized plates are also available for printing the image direct from an intermediary master. Being of higher sensitivity than the sensitized metal plates they can be exposed by tungsten light. Pre-printed paper and plastic plates are also obtainable or can be prepared on the litho machines using a special ink. After preparation by one of the above methods the plate is ready for printing. [62]

The reproducing machine is normally of the power-driven rotary type, and includes a series of inking and damping rollers, an impression cylinder, a blanket cylinder and blanket, an automatic friction or suction feed, and a receiving tray. The prepared plate is fixed to the impression cylinder. When the machine is put in motion printing ink is automatically fed over the inking rollers. After a thorough ink distribution, the ink rollers are brought into contact with the impression cylinder so that the image on the plate (which has already been damped) is inked. The plate is also in contact with the blanket, on which the inked plate deposits or sets off (hence the name "offset") a reverse image of the matter on the plate. The blanket is brought into contact with the rolling-off paper and prints a positive image. [63]

The process can be recommended :—

- (a) for long runs which are not large enough to justify printing outside the department;

- (b) when the plate will need to be revived at a later date to make more copies;
- (c) when line drawings or half-tones have to be reproduced in quantity;
- (d) when copies must be reproduced on a paper having a writing surface;
- (e) when more than one colour is to be used in the reproduction of copies; and
- (f) when permanence of the copy is necessary. [64]

The use of paper plates enables shorter runs to be made economically and special small offset machines are available, if desired, for use with this type of plate.

[65]

TYPE-SET

The type-set duplicator is an office model of a printing machine. It reproduces by the use of ink ribbon, or printing ink, from a metal type face, a zinc or an electro. [66]

Typewriter type or printers' type can be used. The type characters are selected and assembled in a composing fork which holds a line of type. The type is transferred from the composing fork to a type segment by placing the fork in line with a channel on the segment and sliding the type into the channel. [67]

The semi-circular type segment is fastened to the drum of the duplicating machine, which is fitted with either an inked ribbon or inking rollers, a feeding hopper and a receiving tray. Paper may be fed to the machine by hand or by an automatic friction or suction feed. [68]

The machine may be fitted with an automatic numbering device and a signature plate. [69]

This process can be recommended for:—

- (a) long runs which are not large enough for printing;
- (b) reproduction of half-tones and line drawings;
- (c) reproduction of letter headings, etc.;
- (d) printing on cards and other difficult surfaces;
- (e) reproduction of periodical publications in which the bulk of the matter remains constant but certain lines or paragraphs are likely to be changed in different editions. [70]

PHOTOCOPYING PROCESSES

Photocopying processes are associated with the work of the drawing office for the reproduction of plans and drawings and with general office procedures where records, specifications or typewritten documents in technical or scientific language need to be reproduced in

reasonably small quantities. There are many photo-copying processes, all of which will reproduce good, clear copies. [71]

DYE-LINE

The original matter from which copies are to be made by dye-line should be recorded on a transparent or translucent material. The best results are obtained from an opaque line, such as Indian ink on tracing cloth or translucent paper. [72]

The paper on which copies are made is dye sensitised and is available in two varieties known as dry and semi-dry. Exposure is made by contact with the original drawing in a photoprinting machine. A continuous photocopier carries along the tracing and sensitised paper at a predetermined speed, at the same time exposing the paper to a powerful light source either arc, mercury or quartz. The dry type of diazo paper is developed by ammonia fumes, the semi-dry by surface contact with a developing fluid. Special machines are available for both types and a number of makes provide facilities for both the exposing and developing in the same machine. The semi-dry type is also ready for use within a few seconds of development. [73]

BLUE PRINTS

In this process, the original from which copies are to be made should be prepared in the same way as for dye-line prints. A ferro-prussiate paper is used for making the copies and the process through the copier is the same as for dye-line. [74]

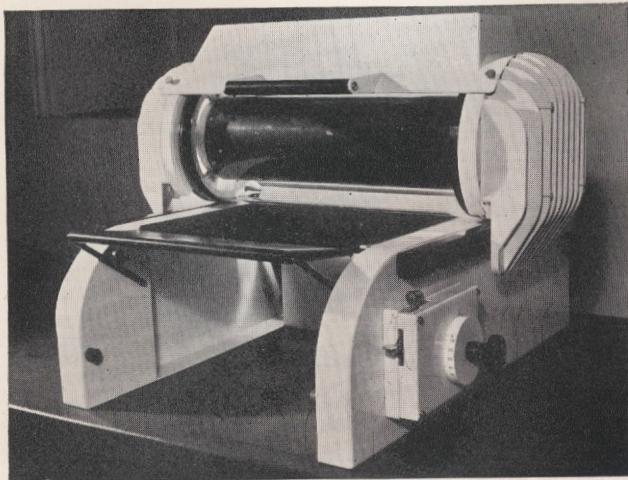
The prints are developed by the application of clear water. There is a subsequent process of drying and a risk of paper distortion. [75]

Dye-line prints are generally preferable to blue prints since corrections and additions are easily made by pencil or ink. The blue print, however, does not mark so readily and is therefore occasionally preferred for workshop use. [76]

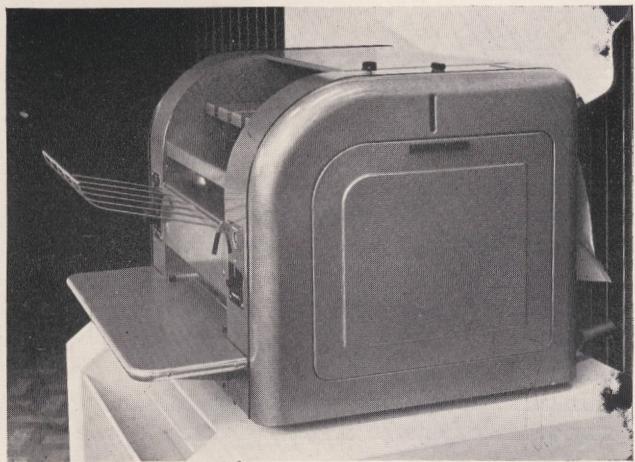
TRUE-TO-SCALE

True-to-scale reproduction is really a lithographic process. The original from which copies are to be made should be prepared as for blue prints. A ferro-prussiate copying paper is exposed in contact with the original in a photocopying machine; no development is required. [77]

Copies are taken from a true-to-scale table, consisting of a flexible band evenly coated with a gelatine composition, which must always contain a certain amount of moisture. The exposed ferro-prussiate paper is placed face down upon the table and brought into close contact with the gelatine substance. Where the line of the



SMALL OFFICE DIAZO MACHINE
DESIGNED TO ACCOMMODATE BOOKS



SMALL COMBINED ROTARY PRINTING AND DEVELOPING UNIT



DRY PROCESSING BLOCK



COMBINED AUTOPOSITIVE AND
DIAZO PRINTING UNIT



DIRECT POSITIVE PRINTER

original has protected the sensitive paper from decomposition the image is "etched" on to the surface of the gelatine. When printing ink is applied to this surface it adheres only to the etched lines. Copies are obtained by pressing the printing off paper against the inked image on the table. [78]

This process may be recommended when only a small number of copies are required. It is also useful for reproducing small quantities of prints in a number of colours. [79]

In suitable cases plates for office offset litho machines may be made from the image on the true-to-scale table. [80]

PRISMATIC CAMERA

The prismatic camera is a machine for making reproductions of documents. It consists of a large camera fitted with mercury discharge lighting, but in place of films or plates, a roll of sensitised paper (350 feet) is provided. A prism for reversing the image is fitted to the lens so that all copy, whether in negative or positive form, is readable. All machines are fitted with a book-holder and a copy board which are adjustable to any position for making reductions or enlargements. [81]

In Departments the wall type model is more commonly used. The paper magazine is housed inside the dark room in proximity to the processing sinks. The drying apparatus is normally operated outside the dark room and the positioning of the originals on the copy-board is carried out in normal room illumination. [82]

On the pedestal type of machine a developing and fixing tray is fitted and every exposed sheet is wound direct into the developer, cut to the desired length, and after development, again moved into the fixing solution. A syphon washer and a drying machine are essential to complete the process. [83]

Prismatic cameras are available in two sizes, the smaller of which makes copies to a maximum size of 14 in. x 18 in. and the larger up to 18 in. x 24 in. It is economical in both labour and paper to set up several documents on the copy board at one time whenever possible. [84]

The process can be particularly economical when the negative print is acceptable as one of the final copies and when only a small number, say, up to ten copies of one document are required. It is uneconomical as a means of reproducing large numbers of copies. The process is also suitable for work involving enlargement or reduction. [85]

REFLEX

The reflex process box is used for copying from opaque originals. The original is placed in a frame with the image facing downward and in contact with photographic sensitive paper. The exposure is made by transmitted light penetrating the sensitised paper. The exposed sheet is processed by normal photographic developers and a reversed negative copy is obtained. When dry the negative is held in the box in contact with sensitised paper which produces, after development, a positive copy. No enlargement or reduction is possible by this process. [86]

Reflex prints can be made on paper, translucent cloth, glass, or metal (template). The process has been much used in small offices for copying plans and general documents. [87]

New processes using the reflex principle to create a master and produce the subsequent copies on diazo paper are now available. [88]

One of these processes uses a special diazo foil which enables a translucent intermediate master to be created from any original. The master is used for producing further prints on diazo paper. [89]

Another process uses auto-positive type of paper to create, by exposure and development, a direct positive of the original, this method enables subsequent copies to be printed by auto-positive or diazo materials according to the type of equipment used. [90]

REFLEX TRANSFER

Apparatus and materials are available for this process under a variety of names, but in principle they are essentially the same. The document is exposed in contact with a special reflex paper which is then passed through a developing machine and brought in contact with a transfer paper. When separated they produce a negative and a positive copy of the original. Translucent transfers are available and these enable additional copies to be produced on diazo paper. [91]

PROCESS CAMERA

The process camera is much used for reducing maps or operational drawings to a size suitable for printing by plan copying or offset processes and for half tone reproduction of photographs. The camera will take all sizes of films and plates up to the maximum size of the equipment in use. The size in common use in Departments is 16 in. x 20 in. which is used extensively to prepare negatives up to 13 in. x 16 in. in size for making plates for offset litho machines. [92]

For reducing drawings and similar materials special cameras and enlargers are used. The camera produces a negative normally of half plate size ($6\frac{1}{2}$ in. $\times 4\frac{3}{4}$ in.) which can, if required, be used in the enlarger to create a new master which may be enlarged, reduced or of the original size. These small negatives can also be used to reduce the space required for little used drawings or as a security measure against destruction. The method may also be used to eliminate the necessity for tracing drawings by producing an intermediate master of increased contrast. [93]

To meet the same requirements, cameras fitted with roll film 70 mm. ($2\frac{3}{4}$ in.) wide giving a picture area of $2\frac{5}{8}$ in. $\times 3\frac{1}{2}$ in. are also being used. These are similar to the normal microfilm cameras, the greater area of film giving a more satisfactory result with the larger drawings. Any photographic enlarger able to accommodate a negative $3\frac{1}{2}$ in. $\times 2\frac{1}{2}$ in. can be used for subsequent enlargement of the negative. [94]

MICROPHOTOGRAPHY

The applications of microphotography are extending over many fields and microfilm apparatus is being developed to meet these new and growing requirements. Cameras using both 16 mm. and 35 mm. roll films are employed as well as sheet cameras for providing either positive sheet films or opaque cards. [95]

The roll film cameras are of two types:

- (a) continuous (flow) type;
- (b) automatic repeat type.

[96]

CONTINUOUS (FLOW) TYPE CAMERAS

The continuous type, usually of 16 mm. size, is fed by hand or automatic means at high speeds. These cameras are able to film only from single sheets of a limited width (approximately $11\frac{1}{2}$ in.) but are not limited in length. [97]

The documents to be copied are fed through an opening in front of the camera and are automatically photographed during their passage round a revolving drum. The originals are carried into a receptacle in the order in which they are fed into the machine. [98]

Some machines are able to photograph both sides of a document simultaneously using half the film width for each side of the document. The maximum reduction given is 40:1 which can film approximately 10,000 letter-size documents or 25,000 cheques on a film 100 feet in length. [99]

AUTOMATIC REPEAT TYPE CAMERAS

This type of camera is designed for copying larger sheets or material in book form. They normally use 35 mm. film, frequently unperforated. Exposure is made by a switch after which the film is automatically moved ready for the next exposure. The changing of pages is done manually and the output of these cameras is therefore considerably lower than that of the flow type. The 35 mm. film 100 feet in length, produces 800 full frame or 1,600 half frame exposures. [100]

MICROSHEET AND MICROCARD CAMERAS

Microfilm cameras using film in sheet form have recently been introduced. Up to 100 micro-reductions can be recorded on a sheet of film 5 in. \times 3 in. The negative is then printed to provide a positive film called a "microsheet" or an opaque card known as a "microcard." [101]

THE USES OF THE VARIOUS MICROFILMING PROCESSES

Copying by micro processes can be very economical when reference to the film record is made by the use of a reader or projector; it can be costly if all the copies have to be reproduced in the size of the original on photographic paper. As a guide, an enlargement 8 in. \times 10 in. costs about 1s. and larger documents are calculated at the rate of about 1s. 9d. per sq. ft. [102]

The microfilm process can be recommended for:—

- (a) copying vital records as a security measure;
- (b) reducing the weight and space of documents to be transmitted;
- (c) reducing storage space for bulky records requiring only a minimum reference;
- (d) creating a new set of records when reference to the original is not convenient.

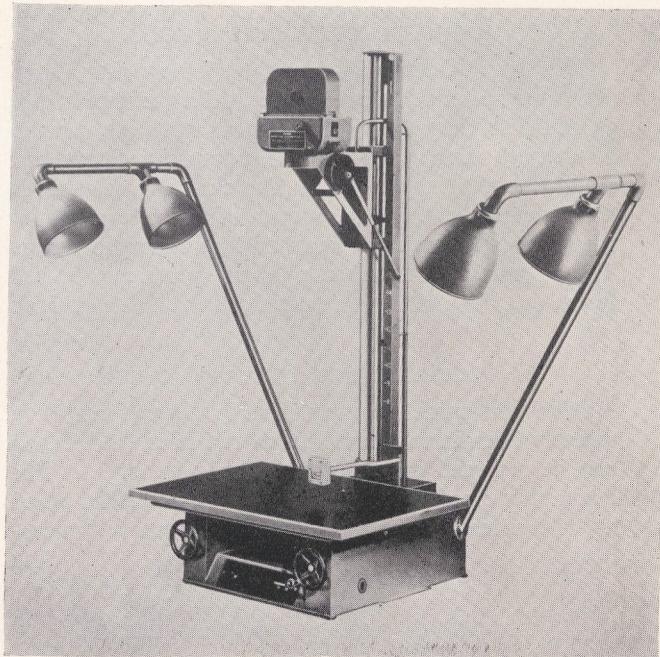
[103]

The opaque techniques are used as a publication medium for out-of-date books which do not justify a reprint and also for publication in reduced form of scientific and technical material for reference purposes.

[104]

READERS AND PROJECTORS

Readers and projectors are available for all types of microfilm and opaque cards. Many designed for 35 mm. roll films are able to accommodate 16 mm. films and by the use of an additional lens give the higher magnification required. Projectors able to accommodate both 16 mm. and 35 mm. film and in addition sheet film up to 9 cm. \times 12 cm. are also available, but those designed for the opaque microcard are restricted to that medium. [105]

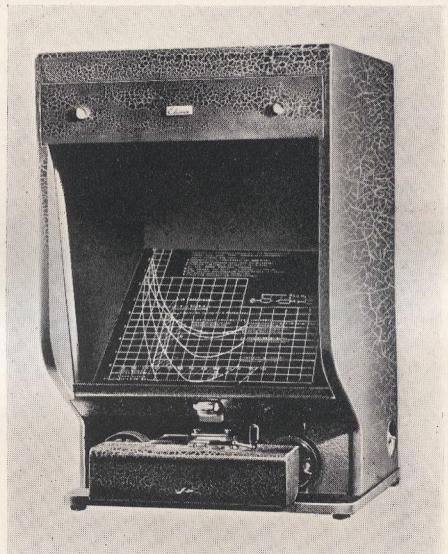


AUTOMATIC REPEAT MICRO CAMERA

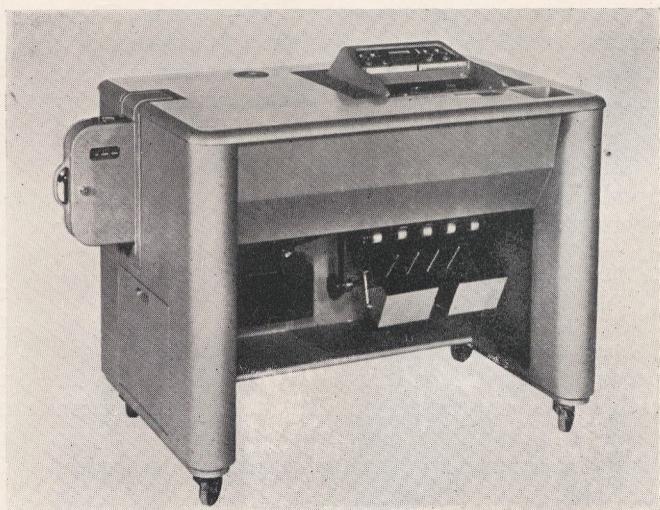


MICROFILM READER WITH TRANSLUCENT SCREEN
FOR 16 AND 35 MM. FILM

MICROFILM READER
WITH OPAQUE SCREEN
FOR 16 AND 35 MM.
FILM



MICROFILM READER TRANSLUCENT SCREEN
FOR 16 MM. FILM



CONTINUOUS (FLOW) MICRO CAMERA

The use of a microfilm reader obviates the costly process of making photographic enlargements but many of these projectors are able to produce a photographic copy if necessary. [106]

AUTOMATIC ENLARGERS

The use of the Airgraph system for producing paper copies from microfilm was widely developed during World War II. Similar apparatus using 16 mm. and 35 mm. film is also used in large departments in which both film and sensitive paper are moved synchronously through the machine giving in the case of the 35 mm. an enlargement of 8 diameters to produce a print $12\frac{1}{2}$ in. \times $7\frac{1}{2}$ in. The sensitive paper is moved through the processing machine attached to the enlarging head and is finally dried before delivery. [107]

ADDRESSING MACHINES*

There are two types of addressing machines in general use:—

- (a) those which reproduce from an embossed metal plate; and
- (b) those which reproduce from a cut stencil. [108]

EMBOSSED METAL PLATES

The plate, which is the means of reproduction, can be made up in two ways:—

- (a) a single piece of metal, all of which (guides excepted) is embossed, or
- (b) a frame which holds the embossed metal insert and an index card. [109]

Plates are available in several sizes, those in general use providing space for from five to nine lines of entries. The number of characters which may be embossed on one line will vary according to the size of type face, and normally will not exceed 46. [110]

The information to be reproduced is impressed into the plate by a hand or electric embossing machine. These machines consist of punches and dies carrying the type characters, a plate holder, a movable carriage with automatic spacing and a wheel or keyboard for selecting the characters to be embossed. The dies include "blanks" to block out errors or obsolete information. The same part of the plate can be re-embossed and amended several times before the metal begins to break. Machines are available carrying between 44 to 90 dies and the characters can be in small or large type, including imitation typewriter styles. [111]

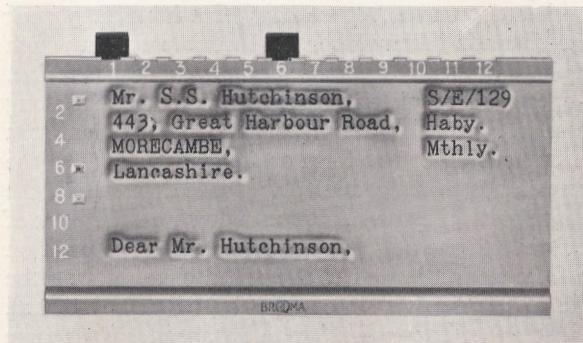
A printing machine (hand operated or electric) is used to make impressions from the plates on to forms

* Additional information is available in the booklet "Addressing Machines in Government Offices".

or other documents. It consists of a hopper; platen; plate channel; inked ribbon, and a receptacle in which the plates drop after having passed through the machine. In operation the plate is passed from the hopper along the plate channel and under the inked ribbon at a printing position. The form or document on which the impression is to be made is placed face down above the ribbon; and the platen is brought down on the back of the form and the pressure causes the ribbon to print on the form an impression of the raised characters on the plate. The platen is raised, the form is removed, and unless further impressions are to be taken from the same plate, the plate passes along to the receiving tray, and the next plate is brought into the printing position. [112]

The plate or frame contains positions for classification tabs or labels which facilitate visual selection of plates and, on some machines, can be used for automatic plate selection. Visual selection is possible on some machines by colour coding on the plates or frames. Mechanical and/or electrical selection can be achieved on some machines by tabbing or piping. Other features which may be fitted to certain basic models and many of which have now become standard equipment are as follows:—

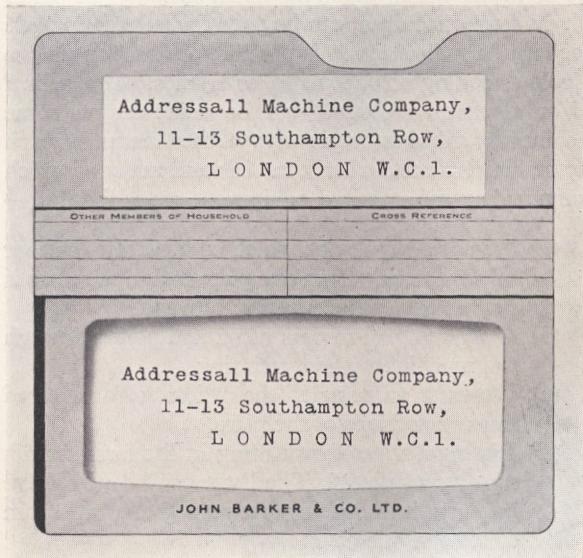
- (a) A multiprint device which controls the number of prints made from one plate before the plate is passed out of the printing position.
- (b) A skip control to pass unwanted plates through the machine without printing.
- (c) Cut-outs to restrict the printing to selected lines or portions of the plate.
- (d) Listing devices for printing in list form from a number of plates. The lister can be set to give any required spacing between the prints from successive plates.
- (e) A date or description channel outside the normal plate printing area in which information composed in loose type, stereo or on an embossed part plate may be reproduced with every plate impression. Constant information can also be printed within the normal plate printing area from an embossed part plate which is held in position throughout a run by an attachment designed for the purpose.
- (f) A hand set or automatic numbering device which may repeat the same number for several successive impressions or may change the number after each impression.
- (g) An item counter to register the plates or number of impressions made from the plates.
- (h) An attachment for semi-automatic feeding of individual forms.
- (i) An automatic device to feed and eject the forms.
- (j) An automatic plate selector which may be operated by tabs affixed to the plate or by bosses or pips embossed on the plate.



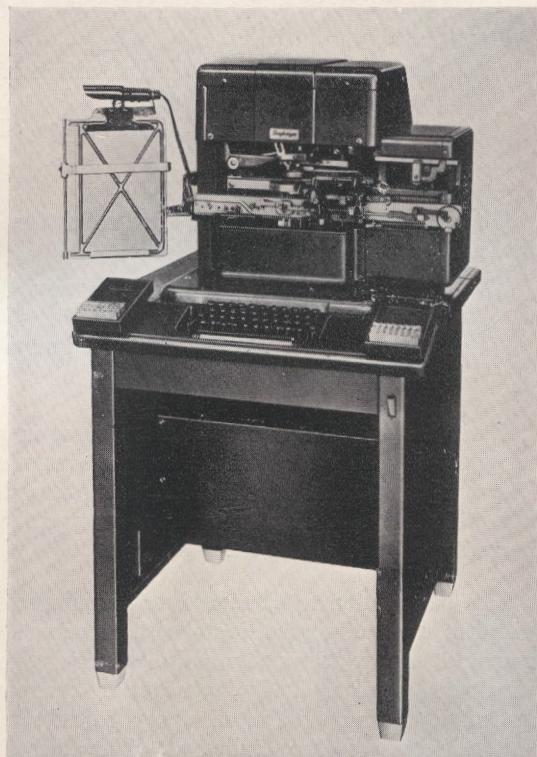
EMBORESSED SINGLE PIECE METAL PLATE



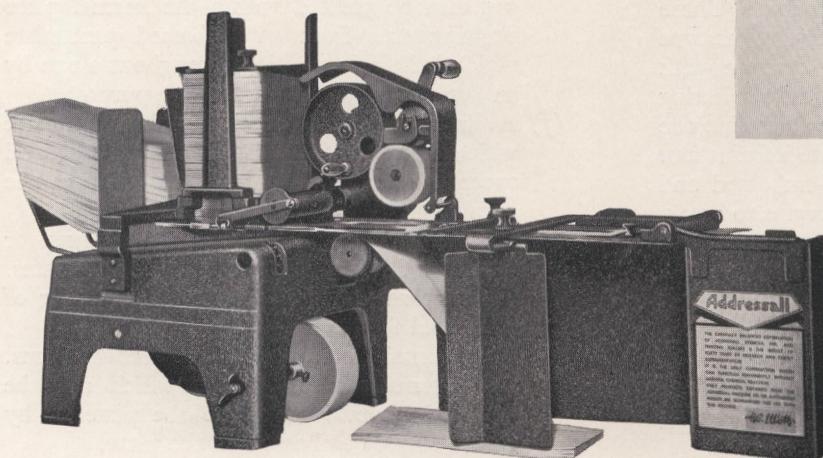
METAL PLATE TYPE PRINTING MACHINE



ADDRESS STENCIL



METAL PLATE EMBOSsing MACHINE



STENCIL TYPE PRINTING MACHINE

- (k) An attachment for feeding paper from a reel or pack in a continuous strip and cutting off at a pre-set measurement.
- (l) An attachment for facsimile letter writing with provision for signatures and dates.
- (m) An attachment for feeding continuous cards.
- (n) An attachment for letterpress printing in conjunction with address plate printing.
- (o) An electronic device enabling the automatic selection of plates to be controlled by a punch card sensing unit.
- (p) A continuous plate loading attachment.
- (q) Multi-headed platen for taking up to four varying impressions from the same plate in one operation.
- (r) A sliding pad or automatic or hand control cut-out to provide two different impressions from each plate in one plate run.
- (s) Visible and/or audible signalling drawing operators attention to plates requiring special treatment.
- (t) Simultaneous preparation of statements of accounts or dividend warrants and relative lists in one plate run.
- (u) A transverse carbon paper roll feed for producing carbon copies when using continuous stationery.
- (v) Variable part platen controlled by selector box.
- (w) Litho ribbons are also available which permit masters to be made on plastic plates for offset reproduction.

STENCIL

The stencil equipment differs from the metal plate equipment in the following respects:—

- (a) the stencil may be cut by handwriting with a stylo or by a typewriter, and no embossing machine is needed;
- (b) the machine uses printing ink for making reproductions;

ADDING AND CALCULATING*

PURPOSE OF MACHINES

Much of the adding and calculating in the accounting, statistical and research work of the office can be done with greater speed and accuracy by machine than with non-mechanical methods. All three classes of work normally involve addition, subtraction, multiplication and division, but the nature of the calculations and the proportion of one type to another varies with each class of work. [118]

- (c) for automatic selection of stencils, holes are punched in selected positions in the cards on which the stencils are mounted;
- (d) a greater range of classifications can be accommodated on the stencil system and automatic selection can be on a single or multiple interest basis for which a duplicate set of metal plates would have to be maintained;
- (e) it is not possible to obtain carbon copies when using stencil addressing equipment. [114]

SPirit

There is a third type of addressing machine which is very simple in construction and useful for reproducing small quantities of a limited number of addresses. The spirit duplicating method is used by these machines. [115]

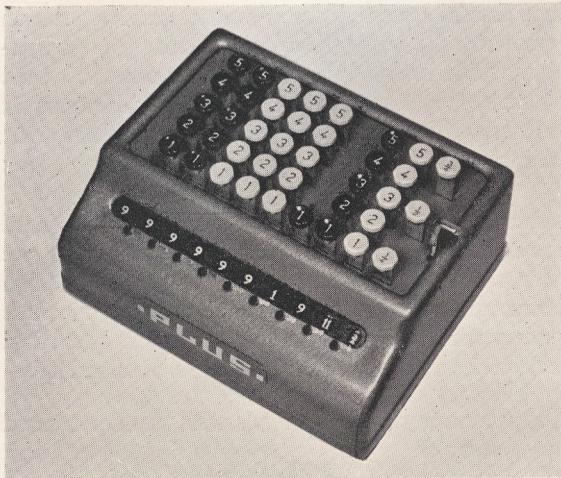
APPLICATIONS

Addressing equipment may be recommended as a means of reproduction:—

- (a) when the information embossed on the plate will be reproduced at least five times per annum over a minimum period of three years or 15 times at one or more than one time provided that the information to be reproduced will remain fairly constant;
- (b) when the whole or part of the information on the plate can be reproduced on a variety of forms;
- (c) when the information on the plate will remain reasonably constant. [116]

Some of the purposes for which addressing equipment may be used are:—

- (a) for addressing envelopes, labels, cards;
- (b) for heading forms, records, statements;
- (c) for printing payable orders, cheques, receipts, clock cards, pay envelopes; and
- (d) for the preparation of lists, e.g. the printing of the constant information on pay lists and on schedules of payment. [117]



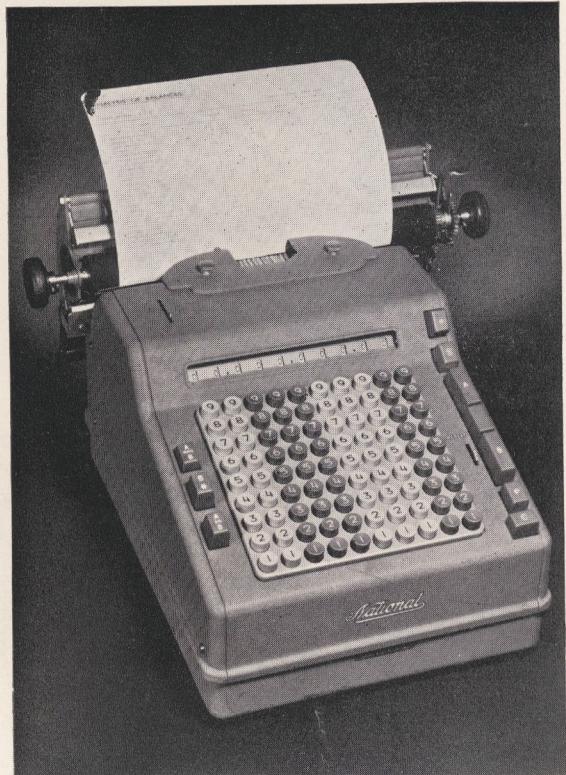
NON-LISTING ADDING MACHINE



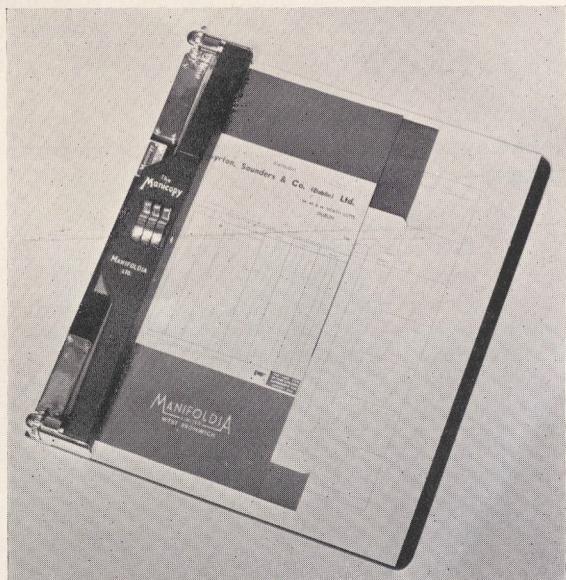
SIMPLIFIED KEYBOARD ADDING LISTING MACHINE
WITH NARROW CARRIAGE, HAND OPERATED



STATISTICAL SUMMARY BOARD



FULL KEYBOARD ADDING LISTING MACHINE
WITH WIDE CARRIAGE. ELECTRICALLY OPERATED



COPY WRITING SYSTEM USED FOR LEDGER POSTING

- (c) calculating interest, discounts and percentages;
- and
- (d) currency conversions.

Generally the bulk of the work is addition with a lesser volume of multiplication and only a small amount of division and subtraction. [119]

A statistics branch is concerned with a wide range of calculations including:—

- (a) addition in whole numbers and decimals;
- (b) percentages;
- (c) averages;
- (d) correlation and equations.

The proportion of addition to other calculations is generally lower in a statistics branch than in an accounts branch. The amount of division is usually much higher. [120]

A research branch is normally concerned with more complex mathematical formulæ in which addition plays only a small part. [121]

CLASSES OF MACHINES

Machines fall into two broad classes.

- (a) Adding machines which are designed primarily for the addition of amounts and in certain models for addition and subtraction. These machines generally are not well suited to either multiplication or division.
- (b) Calculating machines which are designed primarily for multiplication and division but can be used for addition and subtraction. The key-driven calculator, however, is commonly used for addition, subtraction, multiplication and division. [122]

ADDING MACHINES

Adding machines can be further subdivided into two groups:—

- (a) non-listing machines which register on the machine itself the totals of the amounts added; and
- (b) listing machines which print the individual amounts entered and the totals on a strip or sheet of paper. [123]

Non-listing adding machines are usually provided with a half-keyboard; that is, a column of five keys 1—5 for each digit of the capacity of the machine. Depression of the keys rotates the adding wheels (i.e. the machine is key driven). The machine is suitable only for addition; if subtraction is required a key-driven calculator is necessary. [124]

Since amounts are registered by the simple operation of depressing the keys, the speed of adding on a non-listing machine is usually faster than that attained on the listing machine described below. The difference in speed lessens, however, as the size of the amounts to be added increases. [125]

As there is no paper record of the amounts registered on the non-listing machine, it is essential that the operator should be properly trained to reach a high level of accuracy. This training is given by the machine companies who teach the method of touch operating. A check on the accuracy of the addition is obtained by:—

- (a) comparing machine totals with pre-determined totals; or
- (b) comparing, where appropriate, horizontal totals with vertical totals; or
- (c) making a second addition on the machine and comparing the first and second totals. [126]

Adding listing machines are key-set, that is to say, the amounts to be added are first set up on the keyboard but are not recorded either in the adding register or on the record paper until a crank handle on hand-operated machines, or motor bar on electrically-operated machines is actuated. [127]

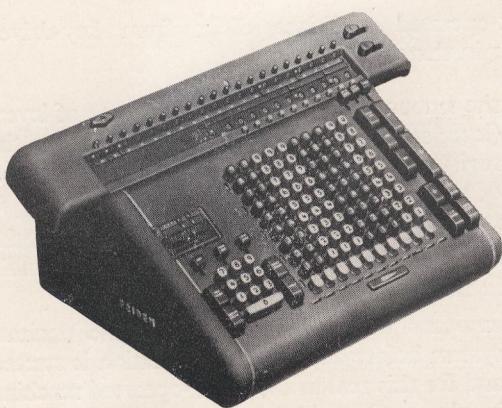
Two types of keyboard are available on adding listing machines:—

- (a) the full flexible keyboard in which there is a full column of keys 1—9 for each digit up to the capacity of the machine;
- (b) the simplified keyboard which has only ten keys 0—9. [128]

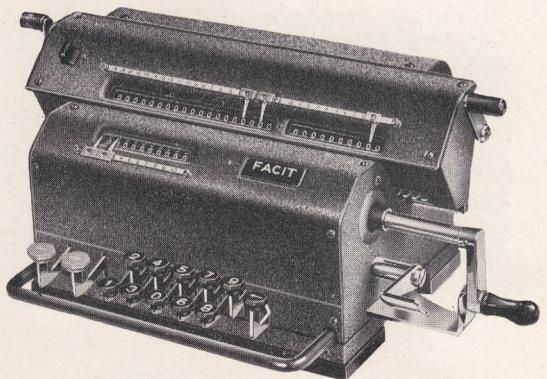
When full keyboard machines are used all noughts are automatically recorded. For example, an amount of £100 would be recorded by the depression of the figure 1 key in the hundreds of pounds column. The simplified keyboard is designed to facilitate keyboard operation by bringing all keys under the control of one hand for touch operation. When using the simplified keyboard all noughts must be entered on the keyboard. [129]

Listing machines are usually provided with a fixed narrow carriage to produce a printed record of all amounts entered and of the totals on a narrow strip of paper (tally roll). They can, however, be fitted with a fixed wide carriage so that amounts can be recorded in a required position on larger documents or with a wide tabulating carriage on which amounts can be recorded in any column desired. [130]

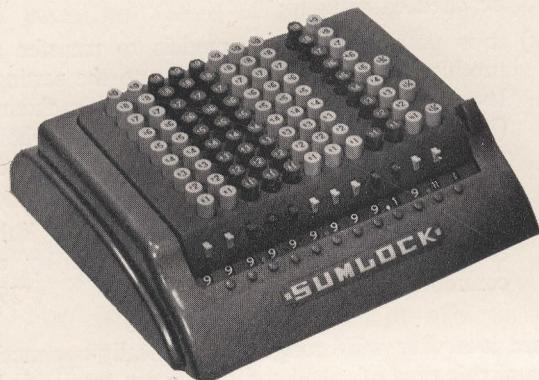
Models of these machines can be equipped to carry out subtraction, and some of these can also be equipped



FULLY AUTOMATIC CALCULATING MACHINE
WITH FULL KEYBOARD



KEY SET CRANK OPERATED CALCULATING MACHINE
WITH SIMPLIFIED KEYBOARD



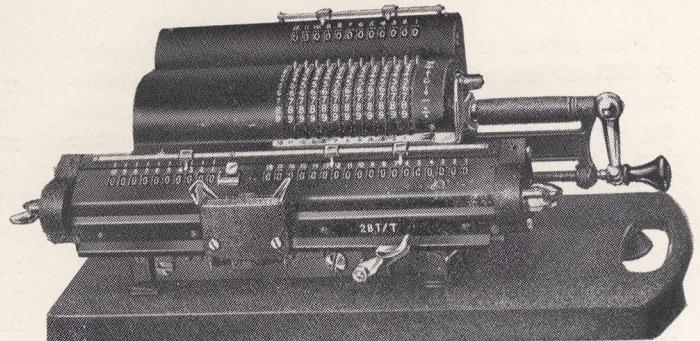
KEY DRIVEN CALCULATING MACHINE



KEY DRIVEN CALCULATING MACHINE WITH TWO
REGISTERS (DUPLEX)



PRINTING CALCULATING MACHINE



LEVER SET CRANK OPERATED CALCULATING MACHINE

to print a true credit or negative balance. With a non-add feature a figure may also be printed as a reference without adding it into the register. [131]

The adding listing machines will print cumulative sub-totals as well as a grand total. Machines with two registers (duplex) are available and these are used when a series of group totals are required as well as a grand total or when two separate grand totals are required as in listing quantities and values. [132]

CALCULATING MACHINES

Calculating machines fall into three groups:—

- (a) key-driven;
- (b) crank-operated;
- (c) printing calculators.

[133]

The key-driven calculator is basically a full keyboard adding machine on which the adding mechanism operates in a forward or positive direction building up to a total. Multiplication is achieved by repeated addition, subtraction by the complementary method and division by repeated subtraction. The machine can be supplied with a sterling keyboard for addition and subtraction direct in pounds, shillings and pence, but for multiplication and division the decimal system is used. [134]

The result of the calculation is recorded in a visible register but the component factors are not shown. There is, therefore, no visual means of checking the accuracy of the calculation. Proof of accuracy needs to be established either by comparing the result with a predetermined figure as when checking extensions, or by doing the calculation a second time. [135]

The speed and accuracy with which a calculation can be completed depends largely on the skill of the operator and a complete course of training should be undergone before any staff begin productive work on the machines. [136]

Some models are fitted with a second register (duplex) so that amounts accumulated in one register as intermediate or group totals can be transferred to the second register for aggregation into grand totals. This feature is useful when, for example, the total of each page or batch of items is required as well as the grand total of all the pages or batches. [137]

Electrically-operated key-driven calculators are available. On these only slight pressure is necessary in order to register the figures instead of the deeper depression required on the hand-operated machines. [138]

Crank-operated machines differ from key-driven machines in that:—

- (a) the amounts are first set up by means of levers (lever set) or keys (key set) and added into the register of the machine by a forward rotation of the crank handle;
- (b) subtraction and division are achieved by the direct method by rotation of the crank handle in the reverse direction;
- (c) amounts must be converted to the decimal system before any type of calculation is started and for this reason the crank-operated machine is slower in addition than the key-driven machine;
- (d) the factors used in multiplication are retained in the machine at the end of the calculation and the accuracy of the calculation can thus be checked visually;
- (e) it is possible on some models to transfer a product from the result register to the setting levers for multiplication by another factor (back transfer feature); a useful feature when three or more figures have to be multiplied together;
- (f) it is possible with certain machines to link two machines together for operation by a common crank handle.

[139]

There is a very wide range of electrically-operated models of this type of calculator. They can be divided into three broad groups:—

- (a) a motorised version of the hand-operated machines;
- (b) semi-automatic, in which the more difficult calculation, division, proceeds automatically having set up the dividend and divisor while multiplication is simply motorised;
- (c) fully automatic in which both multiplication and division proceed automatically after setting up the two component figures. [140]

More elaborate machines are available; for example, to accumulate products, subtract products, accumulate quotients and give automatic square roots. Duplex machines are also available. [141]

Printing calculators are developments of the electrically-operated, simplified keyboard adding listing machine. The figures used in the calculations are recorded on a strip of paper. The capacity of these machines is small compared with other calculators especially if a sterling keyboard is required for addition. [142]

CHOICE OF MACHINES

ACCOUNTS WORK

For the general adding work of an accounts branch the adding listing machine is perhaps the most useful as a desk aid. Also, whenever it is required to retain a record of the addition and subtraction for some subsequent purpose, the adding-listing machine is necessary.

[143]

The extension of time sheets, invoices and similar documents involving addition of sterling amounts and multiplication and division might best be served by a key-driven calculator with a sterling keyboard.

[144]

STATISTICAL WORK

A statistics branch is generally more concerned with whole numbers and decimals than with sterling amounts. A permanent record of calculations is not normally

required and a key-driven adding machine is usually adequate for the work. The key-driven calculator has extensive uses for addition and multiplication. There is even greater use for the crank-operated machine, particularly in those cases where it is not practicable to employ the skilled operator required for the key-driven calculator. With large masses of calculations, and especially those involving large numbers, the electrically operated machines will give the advantage of speed with less fatigue.

[145]

RESEARCH WORK

The research branch has much the same requirements as a statistics branch but because of the more complex formulæ involved, there is often a need for a rather more advanced type of machine. Nevertheless, there are frequently large blocks of calculations following the same pattern which can be adequately handled without resort to the more elaborate machines.

[146]

ACCOUNTING*

PURPOSE OF MACHINES

Accounting machines are used in the Government Service for a wide variety of accounting and statistical tasks, such as:—

- (a) the posting of ledger accounts of various kinds (vote, sales, bill payments and stock) and of ancillary documents;
- (b) the recording, analysis and summarising of statistical data, and of differencing and interpolation work;

and the simultaneous preparation of

- (c) payable orders, Paymaster General's schedules and cash book;
- (d) cheques, posting slips, cash sheets and bank advice slips;
- (e) receipts, cash book and bank paying-in slips; and
- (f) pay lists, wages and tax record cards, employees pay advice slips and pay envelopes or bank advice where necessary.

[147]

The machines supplement but, in the main supersede manual methods of posting entries on accounting documents, and at the same time carry out mechanically various arithmetical operations with the entries, for example:—

- (a) adding and subtracting entries on one line, recording and proving the result;
- (b) adding all entries made in one or several columns and recording the total or totals; and

- (c) subtracting balances from predetermined figures in order to provide necessary information, e.g. unexpired portion of estimate.

[148]

USES OF MACHINES

Accounting machines are a development of adding-listing machines or of typewriters with adding boxes, embodying all the features of those machines with important additions. They provide the means to carry out mechanically all classes of accounting work in accordance with accepted accounting principles. Among the main advantages of machine accounting are:—

- (a) the simplification of procedures;
- (b) the provision of legible records;
- (c) reduction in errors and a ready means of locating errors;
- (d) control by daily balance; and
- (e) simultaneous recording of entries on more than one document.

[149]

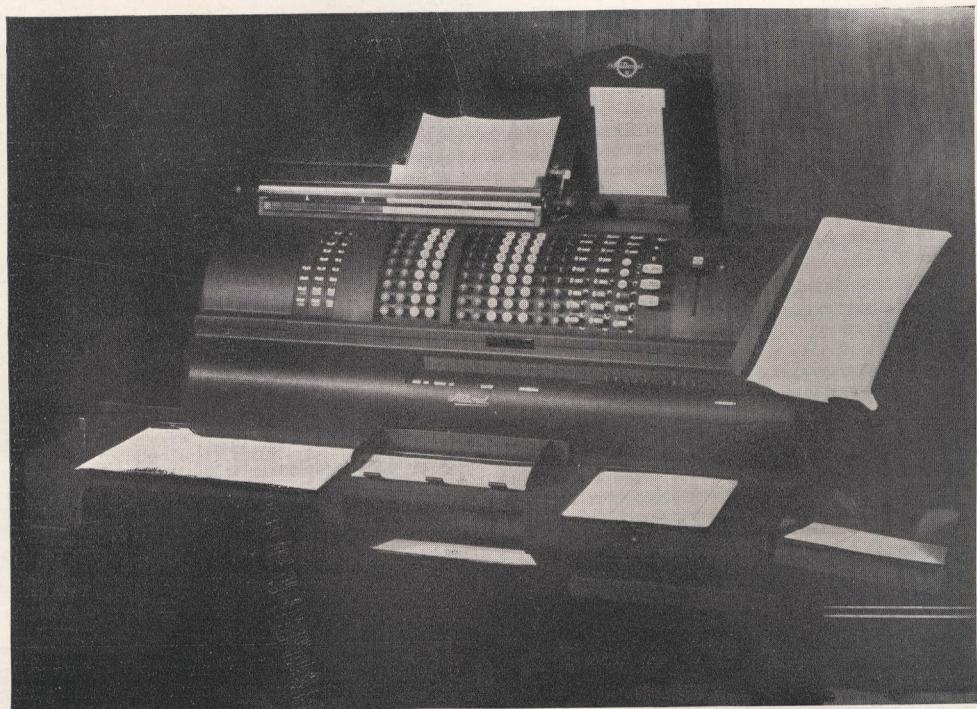
There is only one class of accounting machine which will record entries in a bound book; all other machines require the use of loose-leaf documents. The loose-leaf documents can be used in unit form or in the form of continuous stationery. Column rulings on accounting documents must be spaced to conform with the machine design.

[150]

* This section deals with machines specifically designed for accounting. Punched card equipment, described in the next section, is also appropriate to this work. Further details of accounting machines are given in the booklet "Adding, Calculating and Accounting Machines".



TYPEWRITER BASED ACCOUNTING MACHINE



ACCOUNTING AND ANALYSIS MACHINE

The recording of the new balance after a line or lines of new entries is a regular accounting machine procedure. The new balance is obtained as a normal book-keeping operation using the basic features of the machine as the following illustration shows. Assuming a debit balance and debit entries:—

- (a) the amount of the old balance is read and entered in the machine as a plus;
- (b) the amount of the debit entry is entered in the machine as a plus; and
- (c) the machine records on the document the total of these two entries as the new balance. [151]

In the case of a credit entry the machine subtracts the amount of the credit from the old balance to arrive at the new balance. If there are a number of entries for an account, machines can have an intermediate carriage return feature so that the balance is not recorded at each entry but only on completion. This further speeds the work of posting. [152]

With some accounts such as stock ledger, it may be desired occasionally to record both quantity and value in the line of entry and balances in respect of each. To meet these requirements machines fitted with two balancing registers (cross footers) are available. [153]

FEATURES OF MACHINES

Machines will accumulate totals of individual amounts entered in some or all columns and record them either at the end of a run of postings, or at any stage during the run of work should a total be needed. The amounts in the accumulating registers can be retained in the machine after a sub-total is printed on a document; this is useful when a series of batch or page totals is required. Where sub-totals are not required the registers can be cleared and returned to zero as a total is printed. This method is adopted when a grand total is required at the end of a run of postings. [154]

Because of the need for a line of entry to be recorded on one or more unit documents, and also on one or more schedules or summaries, accounting machines are designed to post the line of entry or part of it on two or more separate documents in one simultaneous operation. According to the class of machine employed the line of entry can be recorded on the several documents by:—

- (a) The use of carbon paper or a special ribbon device. With this method the schedules or summaries are fed into the rear feed of the machine in the same way as paper is fed into a standard typewriter, and the unit documents into an independent feed at the front of the machine. The unit documents can be inserted

or removed without disturbing the position of the schedule or summary.

- (b) Placing documents side by side on the carriage. The machine automatically repeat prints the same information on the documents. The number of items required to be "repeat printed" may affect the number of registers required on a particular machine.
- (c) Recording simultaneously by means of multiple printing heads a line of entry or part of it, on to several documents. [155]

The automatic repeat printing of information set up in the machine is also employed for recording other than purely accounting entries, for example; a constant date during a run of postings or an employee's identity number on the pay list, wage envelope, etc. [156]

Many automatic features are incorporated in the machines to simplify operation and to increase output. These automatically:—

- (a) record the date or an abbreviation without having to reset the machine;
- (b) select the register or registers into which an amount is to be added or subtracted;
- (c) select the column into which an amount or description is to be recorded;
- (d) repeatedly record an amount or a description previously set up in the machine;
- (e) open the front feed device at the end of the line of posting;
- (f) return the carriage to the next line of entry or to a pre-determined position after completion of a line of entry;
- (g) close the front feed device when commencing a line of entry;
- (h) space the lines; and
- (i) record the totals or sub-totals accumulated in the registers. [157]

Most of the automatic features can be controlled from the keyboard of the machine. Where there is a continuous run of postings however, the work is usually programmed on the machine, the required automatic features being controlled by a "programme unit" variously referred to as a control panel, form bar or control plate. The programme units are easily detached or put in place on the machines. In this way there can be a considerable degree of flexibility in the use of machines. For example, a changeover from sales ledger posting to payroll recording is generally a matter of substituting one programme unit for another. In general a particular function performed by the programme unit can be over-ruled by the use of the appropriate key or lever on the keyboard. [158]



ACCOUNTING MACHINE WITH FULL NUMERAL
KEYBOARD AND FOUR SEQUENCE CONTROL
PANEL



ACCOUNTING MACHINE WITH
SIMPLIFIED KEYBOARD AND
DATE AND DESIGNATING KEYS



ACCOUNTING MACHINE WITH FULL NUMERAL
AND ELECTRIC TYPEWRITER KEYBOARDS

LEDGER ACCOUNT				
ACCOUNT NO	NAME _____ ADDRESS _____			
DATE	DESCRIPTION	DEBIT	CREDIT	BALANCE
12 Dec. 45	GOODS	5. 17. 6		5. 17. 6
20 Dec. 45	GOODS	11. 7. 6		17. 5. 0
2 Jan. 46	CASH		17. 5. 0	0. 0. 0

Example of debit and credit postings with the new balance printed at the same time as the posting is made

PROOF SHEETS					
LEDGER ACCOUNT					
ACCOUNT NO.					
PICK UP OLD BALANCE	DATE	DESCRIPTION	DEBIT	CREDIT	BALANCE
14. 15. 2	20 Dec.	Brought Forward GOODS	2. 12. 6		14. 15. 2
17. 7. 8	28 Dec.	GOODS	1. 6. 6		17. 7. 8
18. 14. 2	2 Jan.	CASH		18. 0. 0	18. 14. 2
14. 2	10 Jan.	GOODS	2. 15. 0		14. 2
					3. 9. 2

Example showing pick up of old balance, posting of debit and credit entries and printing of new balances

STOCK LEDGER								
MAXIMUM _____			STOCK NO. _____					
MINIMUM _____			LOCATION _____			DESCRIPTION _____		
DATE	SUPPLIER	ORDER OR I.V. NO.	RECEIVED		ISSUED		BALANCE	
			QUANTITY	VALUE	QUANTITY	VALUE	QUANTITY	VALUE
1 Sep.	W. ADAMS	345	500	25. 0. 0			500	25. 0. 0
2 Oct.		1122			100	5. 0. 0	400	20. 0. 0
12 Oct.		1173			250	12. 10. 0	150	7. 10. 0
2 Nov.	W. ADAMS	456	500	25. 0. 0			650	32. 10. 0

Example of stock ledger posted with quantity and value and both items kept in balance

ANALYSIS JOURNAL							
DATE	TOTAL	VOTE CHARGEABLE					CYPHER PROOF
		A	B	C	D	E	
20 Dec.	540. 12. 9		200. 10. 0				0. 0. 0.
20 Dec.	765. 10. 0	155. 10. 0	410. 0. 0				0. 0. 0.
20 Dec.	1046. 17. 6	546. 10. 0		500. 7. 6			0. 0. 0.
20 Dec.	389. 8. 6	179. 2. 6	210. 6. 0		635. 15. 0		0. 0. 0.
20 Dec.	975. 15. 0				340. 0. 0		0. 0. 0.

20 Dec.	744. 16. 6	125. 16. 3	248. 10. 3	224. 5. 0	146. 5. 0		0. 0. 0.
TOTALS	12289. 15. 6	5182. 17. 3	3252. 16. 6	2098. 15. 6	1052. 10. 0	702. 16. 3	0. 0. 0.

Analysis of charges broken down to Vote Subheads and entries in all columns accumulated to print totals

PROOF SHEET		LEDGER ACCOUNT	
ACCOUNT NO.		LEDGER ACCOUNT	
DATE	DESCRIPTION	DEBIT	CREDIT
20 Dec.		5. 10. 0	
DATE	DESCRIPTION	DEBIT	CREDIT
20 Dec.		7. 17. 6	
DATE	DESCRIPTION	DEBIT	CREDIT
20 Dec.		2. 14. 10	
DATE	DESCRIPTION	DEBIT	CREDIT
20 Dec.		6. 5. 6	
		22. 7. 10	

LEDGER CONTROL ACCOUNT			
DATE	REFERENCE	DEBIT	CREDIT
20 Dec.		22. 7. 10	
		22. 7. 10	

Example showing postings to four separate ledger accounts under one control account. The proof sheet total is posted to the group control account which is kept in balance

POSTING MEDIA

AMOUNT	9.8.6
AMOUNT	3.13.3
AMOUNT	2.12.6
AMOUNT	5.10.0

PRE - LIST

PROOF OF POSTING

The total of the amounts posted, as printed on the proof sheet, is compared with the pre-list total. If the two totals agree, total control is established. If they differ, the individual entries are compared with the amounts on the posting media or on the pre-list and the error is corrected.

POSTING MEDIA

AMOUNT 5. 10. 0.	AMOUNT 3. 12. 6.	AMOUNT 2. 12. 6.	AMOUNT 5. 10. 0.
---------------------	---------------------	---------------------	---------------------

1. ST. PICK - UP OLD BALANCE + * *		PROOF SHEET				2. ND. PICK - UP OLD BALANCE — * 21.		PROOF	
DATE	DESCRIPTION	DEBIT	CREDIT	BALANCE					
20 DEC. 45	GOODS	5. 10. 0.		12. 13. 6.		7. 3. 6.		5. 10. 0.	
20 DEC. 45	GOODS	2. 12. 6.		5. 7. 6.		2. 15. 0.		2. 12. 6.	
20 DEC. 45	GOODS	3. 12. 6.		5. 2. 6.		1. 10. 6.		3. 13. 6.	
20 DEC. 45	GOODS	9. 8. 0.		21. 19. 0.		12. 10. 6.		9. 8. 0.	

LEDGER ACCOUNT		ACCOUNT NO. _____		NAME _____		ADDRESS _____	
DATE	DESCRIPTION	DEBIT	CREDIT	BALANCE			
20 DEC. 45	BALANCE B/F GOODS	9. 8. 6.		12. 10. 6.		21. 19. 0.	

PROOF OF PICK-UP OF OLD BALANCE AND POSTING

The amount of the old balance is first entered and added in the balancing register (cross-footer) of the machine; the amount of the debit posting is added to the old balance and the new balance is printed as a sub-total. The amount of the old balance is then subtracted and the remainder is accumulated in a proof register. The total in the proof register should agree with the pre-list total

PRE - LIST

5. 10. 0.
2. 12. 6.
3. 13. 6.
9. 8. 0.
21. 4. 3. *

POST MEDIA

ACCOUNT NO 228	AMOUNT 9.8.6.
ACCOUNT NO 212	AMOUNT 3.13.3
ACCOUNT NO 198	AMOUNT 2.12.6
ACCOUNT NO 165	AMOUNT 5.1.0

PRE-LIST	165	5.	10.	0.
	198	2.	12.	6.
	212	3.	13.	5.
	228	9.	8.	6.
	803	21.	4.	3.
				*

The Account number is added on the pre-list and also in a proof register when the postings are made. The two totals are compared and if they agree a total control is established

DATE	AMOUNT	REFERENCE	CONSEC. NO OF RECEIPT	ANALYSIS OF AMOUNTS RECEIVED			DATE DUE	AMOUNT	D'V PAYMENTS
				INSTALMENTS OF ANNUITIES DUE					
JAN. 5.	10.	7. 6.	110L3	97	45001				
JAN. 5.		9. 11.	110L8	106		2			
JAN. 5.		17. 8.	11054	105		3			

REMITTANCE SHEET									
DATE	AMOUNT RECEIVED	REFERENCE	CONSEC. NO OF RECEIPT						
JAN. 5.	10.	7. 6.	110L3	97	45001				
JAN. 5.		9. 11.	110L8	106		2			
JAN. 5.		17. 8.	11054	105		3			

RECEIPT		
\$ 45000		

DATE	4	5	D	REFERENCE NO.
JAN. 5.		17.	8.	11054 105

FIG. Illustrating three documents on which the line of entry is recorded in one operation.

PAYROLL

DEPARTMENT: ASSEMBLY							SHEET No. 1		
	EARNINGS			DEDUCTIONS			NET PAY	NAME	REMARKS
	BASIC	OTHER	INCOME TAX	FIXED	VARIABLE				
	3. 6. 0	17. 0	12. 0CR	11. 0	1. 0		2. 19. 0	101.	CLARKE H.
	3. 12. 0	1. 19. 5	1. 4. 0CR	9. 0	1. 0		3. 17. 5	102.	JAMES T.
	2. 14. 0	11. 0	2. 0	7			3. 6. 5	103.	HARRIS D.
	4. 6. 0	2. 15. 9	1. 2. 0CR	16. 0	1. 0		5. 2. 9	104.	GREEN J.
				8. 0			8. 0	106.	ATKINS R.M.
	2. 5. 0	0	6. 11	6			1. 17. 7	107.	KENT O.
	4. 3. 3	2. 15. 4	1. 3. 0CR	9. 0	1. 0		5. 5. 7	108.	LAWRENCE M.
	4. 5. 0	2. 1. 2	14. 0CR	11. 0	1. 0		5. 0. 2	109.	DANIELS R.J.

PAY ADVICE									
DATE	EARNINGS			DEDUCTIONS			NET PAY	NAME	NAME
	BASIC	OTHER	INCOME TAX	FIXED	OTHER				
15 MAY	4. 5. 0	2. 1. 2	14. 0	11. 0	1. 0		5. 0. 2	109.	DANIELS R.J.

CASH ANALYSIS	
BALANCE	
DEPOSITS	
WITHDRAWALS	
OPEN	
TOTAL	

BASIC EARNINGS 24. 11. 3
OTHER EARNINGS 10. 19. 6
GROSS EARNINGS 35. 10. 9
TAX FOR WEEK 4. 5. 0
FIXED DEDUCTIONS 3. 3. 6
VARIABLE DEDUCTIONS 5. 6
NET PAY 27. 16. 9

Illustrating the simultaneous preparation of individual earnings and tax record, pay list and pay advice slip

PAY LIST

PROOFS AND CONTROLS

Apart from the obvious advantages of providing a legible record, speed of entry, and accumulating totals of the amounts recorded, accounting machines provide facilities for maintaining accounts in daily or periodic balance and also simple methods to control the posting of the correct amount to the proper account. A method by which the machine provides an up-to-date balance on each account has already been explained in paragraph 151. [159]

When a large number of accounts is involved it is usually an advantage to group them for example, by vote subheads, or geographical or alphabetical or numerical sub-division and to maintain separate group control or total accounts. With its total account the particular group of accounts becomes in effect a self-contained ledger. The totals of daily or periodic postings to the individual accounts are posted to the appropriate control account and this provides at any time an overall picture of the position of the accounts controlled. Moreover, any error is localised to the smaller number of accounts in each group and is therefore more readily located. [160]

Proofs are employed to ensure that:

- (a) the amount of an entry is correctly posted (i.e. proof of posting);
- (b) the amount of the old balance has been correctly entered in the machine, and entries have been correctly posted (i.e. proof of pick-up and posting); and
- (c) the amounts have been posted to the proper accounts.

The proof that these operations have been accurately carried out can be obtained on accounting machines in a variety of ways. The method employed is usually determined by the type of machine or the number of registers incorporated in the machine. The method of control used is influenced by the volume and frequency of movement on the accounts, since it would not be economical to employ an elaborate system of daily control over a few postings, the accuracy of which could be checked quite simply by a periodic trial balance. It must be remembered that the machine does not eliminate errors in posting, but provides an easier method of locating them. [161]

CHOICE OF MACHINES

The foregoing paragraphs have indicated some of the factors to be assessed in the choice of machines. The range of accounting machines now available covers every type of entry required in accounting procedures. [162]

In considering the choice of an accounting machine regard should be paid to the major purpose for which it is required in particular.

- (a) Whether it will be required to record in full such items as the payee's name on a cheque; a narrative description of a transaction or whether an abbreviated description will suffice. This will determine whether a machine with a typewriter keyboard is necessary or simply a device for printing abbreviations.
- (b) What number of columns will be added vertically and what will be the number of digits in the total of each column. From this can be determined the number of accumulating registers needed, the capacity of each and the width of columns required on each document.
- (c) Whether the line of entry or part of it will be posted to unit documents and summaries. If so, the design of the documents must be related one to the other and a machine with a front feed feature or automatic repeat printing used.
- (d) Whether the entries will include both quantity and value and if so whether both items will be kept in balance. It is possible to maintain the two balances on a machine fitted with one balancing register (crossfooter) but more often a machine fitted with two balancing registers is used. [163]

COPY WRITING SYSTEMS

The volume of work in an accounting section sometimes may not justify the use of a machine for the complete sequence of operations in the posting of accounting records. In such cases, adding and calculating machines often prove useful mechanical aids. Some of the advantages of machine accounting—particularly that of simultaneous preparation of documents and a limited proof of entry—may be derived from the use of "copy writing" or "three-in-one" systems for posting. The essential factor is in the design of precision ruled, and sometimes punched, stationery which is used in conjunction with a hardboard to give a good writing surface. The board may also incorporate devices for the rapid insertion or speedy alignment of the forms. [164]

MACHINE ACCOUNTING TERMS

The following definitions may be helpful.

Posting media: The forms or documents supplying the information to be posted by the machine.

Pre-determined total: The total of the amounts of a batch of posting media prepared in advance of the machine posting and with which the subsequent recordings are agreed.

Pre-list: A list prepared when the pre-determined total is produced by add-listing the individual items on the posting media.

Proof-list: A list compiled on the accounting machine showing the amount of the individual postings and their totals. These totals may be checked and agreed with the pre-determined totals or compared with the pre-list to discover errors. The proof-list can be a carbon copy journal, cash sheet or other document recording in full the actual lines of entry on the unit documents, or it may be a tally roll, i.e. a paper strip on which the amounts of the entries only are recorded.

Total control: The control effected by checking and agreeing the pre-determined total with the proof-list total and recording the total figure in the control account. It will not reveal compensating errors.

Control account: The account to which daily or batch totals are posted in respect of a section of ledger accounts. The total of the individual ledger balances should always agree with the control account balances. Sectionalising the work tends to eliminate compensating errors.

The punched card system in its original form was devised to meet the need for the speedy production of Census statistics. Its use was soon extended to the wider fields of general statistical and accounting work. More recently the machines have been applied in certain cases to specialised activities such as addressing, computing and selective indexing. [166]

Broadly, punched card equipment provides for cards recording numerical or other data to be mechanically sorted, counted, grouped, etc. This is done by sensing the recorded information which appears on the cards in the form of a series of punched holes, and by listing, tabulating and printing the information for presentation in statistical or other form. From the punching of the card to the final tabulation most of the operations are carried out entirely by machine. This makes for a high degree of accuracy and speed. [167]

A broad appreciation of punched card work can be obtained by examining the operation of a punched card system applied to a particular procedure. An example is the compilation of the Civil Service Central Staff Record, the purpose of which is to provide statistics of the numbers, gradings, age distribution, location, etc., of all non-industrial established staff. The various stages in the compilation are shown at pages 43 and 44. [168]

The following section describes the types of cards used, their design and the system of recording information by punched holes. The section after that describes the various kinds of machines and the methods by which they are operated. [169]

Old balance: The amount outstanding on an account before a current entry is posted.

Pick-up: The entry into the machine of the amount of the old balance.

New balance: The amount outstanding on an account after a current entry has been posted.

Register: An accumulating mechanism built into a machine based on the adding machine type.

Adding box: An independent accumulating mechanism built separately from a machine of the typewriter class and which can be attached or detached at will.

Crossfooter: The cross computing mechanism. A register built into any accounting machine which receives all the figures of a horizontal line of entry adding or subtracting as required. The crossfooter acts with and sometimes independently of the vertical adding registers. It should give a true credit balance.

[165]

PUNCHED CARD SYSTEMS

PUNCHED CARDS

DESCRIPTION OF CARDS

There are three punched card systems available: Hollerith, IBM and Powers-Samas. Equipment for these systems is supplied in this country by the following firms:—

Hollerith:

The British Tabulating Machine Company Limited.

IBM:

IBM (United Kingdom) Limited.

Powers-Samas:

Powers-Samas Accounting Machines (Sales) Limited.

[170]

Each system uses cards made of stout manilla paper .007 in. thick and sufficiently strong to withstand the wear and tear of passing many times through machines at high speed. [171]

The cards are available in a variety of colours, or with a coloured signal, and can be supplied already printed with consecutive numbers. All cards are supplied with one corner cut so that operators can see at a glance whether all cards in a stack are standing the right way. [172]

The cards are divided into columns, the sizes of cards and numbers of columns varying according to the make of equipment with which they are used. [173]

SPECIMENInsert codes,
numbers, years etc.
in boxes below

CIVIL SERVICE CENTRAL STAFF RECORD

ENTRY FORM

180	1 Department	Customs and Excise	1a Class of Staff	1
	2 Surname	Atkins	Initials of Christian Names	T
1067	3 Staff number	(insert number in code box)		
4	4 Service with Armed Forces	1914-19	1939-	X
11	5 Year of birth			
7	6 Sex	(insert F1, F2, etc., as appropriate, in code box)		
2	7 Disabled	Not disabled	Designated Employment	
46	8 Year of entry to present Department			
50	9†Year established* or admitted to F.S.S.U.			
46	10 Year of first appointment† If prior to establishment* or admission to F.S.S.U. or φ If prior to entry to present Department.			
6	11†How appointed to establishment* Nomination			
	12†How appointed to establishment* Nomination			
5121	13 Grade in which first established*† or appointed	Clerical Officer		
	14 M.R.P.			
8	15 How appointed to present Staff Group	Nomination		
50	16 Year of appointment to present Grade			
5121	17 Present Grade	Clerical Officer		
18				
—	19 Pensionable allowances (if applicable, insert in code box the amount to the nearest £, followed by code in brackets, otherwise cancel box)			
	20 M.R.P. established in 1939			
400	21 Rate of pay (insert in code box the amount to the nearest £)			
501	22 Location	London (inner)		
1	23 Type of Office			
—	24 Sub-department	(if inapplicable, cancel code box)		
09	25 Superannuation Act or other provision applicable	(if inapplicable, cancel code box)		
—	26 Cause of Leaving	} to be completed only where the officer is absent from the Department serving with the Armed Forces—if inapplicable, cancel code box		
—	27 Year of leaving			
	28†Movement History			
30				
31				

NOTE. It is appreciated that the above items are not arranged in the most convenient order for completion by Departments ; they are so arranged to accord with the order of the personnel record forms in use by the majority of Departments, and to facilitate card punching operations.

1. The entering of information in the space provided on the right of these items is optional, but Departments may wish to complete for checking. The code boxes on the left, however, must be completed unless the item is inapplicable, in which case the code box should be cancelled by striking through.
2. Where the entry to be made in a code box is a date, the last two figures only of the year should be inserted in the code box, e.g. the year 1913 should be shown as 13.
3. See Instructions as to completion of sections 30 and 31 and significance of †, * and φ.

Date of completion of form.....

Wt. 44251/2818 125M 3/47 EJL/3565/4 Gp. 38/3

EXAMPLE OF PUNCHING DOCUMENT PROCEDURE DESCRIBED ON FOLLOWING PAGE

THE PUNCHING DOCUMENT

The first step is to collect the information about each officer. This is done by means of a form on which the various items are recorded, not fully but in the form of code numbers. Each code number will in turn become a hole or a series of holes on a punched card.

PUNCHING THE CARDS

One card is punched initially for every entry form received. The punching is carried out by hand-operated or automatic machines. The operator strikes a key to punch each hole.

VERIFYING

The accuracy of the punching is checked by passing the card through a verifying machine, which is manipulated in much the same way as a punching machine. At this stage any cards found incorrectly punched are weeded out and fresh cards are correctly punched.

INTERPRETING

The cards, now complete with the punched information, are fed into an

interpreting machine, which senses certain pre-determined items, such as the officer's name, and prints them at the top of the card.

REPRODUCING

The interpreted cards are fed into a reproducing machine which produces a further card with punched holes in precisely the same positions as those on the original card. In the Civil Service Central Staff Record these cards are dual purpose cards, i.e. they are designed so that amending information can be written in the spaces between the rows of punched holes. They are retained in the Departments until a change occurs; they are then completed with particulars of the amendment and sent to the central installation.

SORTING

As the cards record various items of information about an officer, it is necessary for the purpose of compiling statistics to group like cards for example, all officers aged 57, all dis-

abled officers, and so on. The sorting machine is so constructed that it will sort cards according to the punching in any one column at a time, and thus, by setting the machine to sort consecutively on the columns of given fields, the cards may be arranged in the required categories.

TABULATING

The cards, having been sorted and arranged in the required categories and sequence, are ready to be fed into the tabulating machine, which will count and list the number of cards (and thus the number of officers) in each group and will print totals of each group and grand totals of the combined groups. At this stage statistics are ready to be built up.

This represents no more than the briefest outline of one kind of job that can be done on punched cards. Some impression of the many other practical applications of the equipment may be got from details of the cards, machines and operations described in paragraphs 170 to 224.

The basis of recording on the cards is numerical; the method is by punched holes. Numbers containing one or more digits can be recorded, each number occupying one or more columns. For example, a number containing three digits would require three holes to be punched, one in the appropriate position in each of three consecutive columns. These groups of two or more columns are known as "fields."

[174]

In each column there are 12 positions in which a hole could be punched; except in 21 column and 36-column cards, where there are 11 positions. Ten of these punching positions are numbered 0 to 9: the other two are unnumbered. The capacity of some cards can be increased by using the upper positions in the card in combination with the 1-9 positions. Further increased capacity can be obtained by the employment of special techniques such as DUCOL (Hollerith), Intersense and 130 column (Powers) all of which require the use of appropriate recording and processing equipment. [175]

CODING INFORMATION FOR PUNCHING

Although the systems are basically numerical, they are not restricted to the recording of quantitative data. Almost any information can be recorded on a punched card provided it is first converted into numbers. For example, it might be necessary in taking a census to record which people were married and which single. This could be done by coding all married persons as 1 and all single as 2. Further examples are given on the entry form for the Civil Service Central Staff Record (see page 43). [176]

When it is required to interpret names or other alphabetical data, special punching is used. The alphabetical characters are recorded on the card by punching two holes in each column: each pair of holes in each column representing an alphabetical character. [177]

DUAL-PURPOSE CARDS

The dual-purpose card (see page 44) is first a document bearing the handwritten or typewritten information to be punched, and secondly a punched card for passing through the various punched card machines. The cards are designed with enough space between the rows of punched holes for information to be written in, either before or after the holes are punched, and to be visible for reading. On some machines cards are completely visible to the punching operator throughout; on others they are only partly visible. [178]

The value of these cards is that the information is recorded both in manuscript and by means of punched holes and that they, therefore, can be used as a reference record as well as for punched card purposes. [179]

PUNCHED CARD MACHINERY

The machines described below are arranged as far as possible in the order in which they are brought into use in a typical punched card job. A short explanation of the operation from which the machine takes its name is given first.

[180]

MAKES OF EQUIPMENT

The main differences between machines for the three systems arise from different methods of reading or "sensing" the punched cards. Hollerith and IBM equipment is based on electrical contact. That is to say, when a punched card passes between a wire brush and a metal roller, electrical contact is made between the brush and the metal roller through the holes in the card. Powers-Samas machines employ a system of mechanical sensing. As the punched card passes through the machine, metal sensing pins signal the presence and positions of the holes in the card. [181]

Although in individual machines the features provided by one company differ from those provided by the others, it may be accepted broadly that whatever operations can be undertaken on one make of equipment can also be undertaken on the others. [182]

PUNCHING

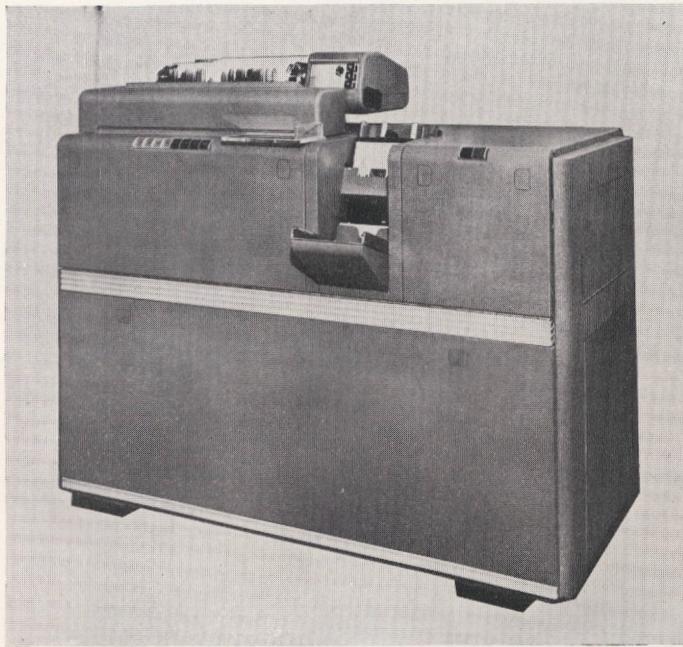
Punching is the process of registering information on the card by means of punched holes. Gang-punching is the automatic operation of punching into a group of cards data common to all cards in that group. [183]

The speed of punching varies according to the arrangement of the items on the document supplying the information to be punched; the number of holes to be punched in each card; the number of cards to be punched in one run; the skill of the operator; and whether a hand-operated or automatic machine is used. [184]

A more detailed description of these operations can be found in the publication: "Creating the Punched Card" (February 1953). [185]

HAND KEY PUNCHES

Hand punches are available for both systems. The hand machine is fitted with a keyboard with 14 keys: 12 corresponding with the 12 number positions in each column of the card, one for spacing and one for release. The holes are punched by knives connected to the keys. A carriage holds the card in position and moves the card along after each punching key is struck. A skip bar or adjustable tabulation stop causes the punch to automatically skip over those columns not required to be punched. The card is inserted and ejected by hand. One model has electrically actuated punching knives. [186]



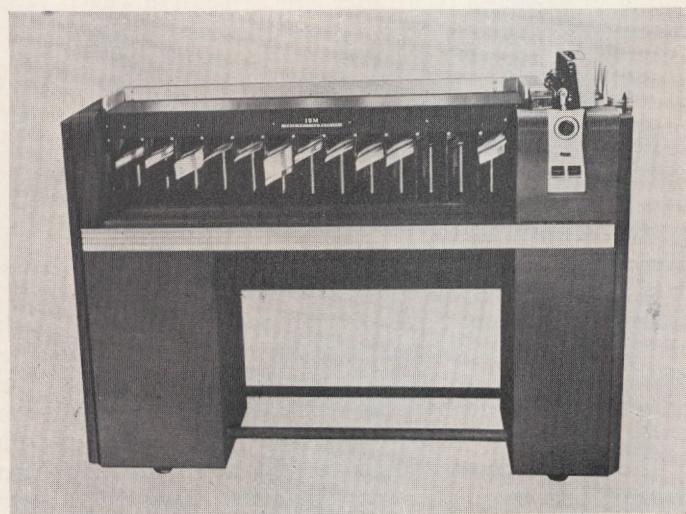
IBM ALPHANUMERICAL ACCOUNTING MACHINE
(TABULATOR) TYPE 421



HOLLERITH REPRODUCING PUNCH



HOLLERITH COLLATOR



IBM SORTER

AUTOMATIC KEY PUNCHES

These machines are basically similar to hand punches but several of the manual operations have been made automatic and additional functions have been incorporated. Common automatic features include feeding new cards to the punching position and ejecting them into a hopper after punching, carriage return, power driven punching knives, programmed spacing, skipping, start and finish punching positions on each card, and gang-punching facilities. [187]

On some machines, holes are punched column by column as keys are depressed; on others, the punching takes place only after all or a predetermined part of the information to be recorded in each card has been pre-set or stored by key operation. [188]

Other features available on some machines include portable keyboards connected to the machine by electric cable (one model being designed like a typewriter for alphabetical punching), full visibility of the cards during the punching operation, card counting and numbering devices. [189]

OTHER PUNCHING EQUIPMENT

Information can also be punched into cards by employing special techniques and equipment as follows:

- (a) Spot Punching—a method of recording limited variable data in cards by means of a pocket punch.
- (b) Mark Sensing and Mark Scanning—methods of recording direct on to cards with pencil or pen, such recordings being subsequently sensed or read during passage of the cards through special reproducing machines which automatically punch the appropriate holes in the cards.
- (c) Tape-to-Card machines—a system permitting cards to be automatically punched from perforated teleprinter tape. Alternatively Card-to-Tape machines will produce perforated teleprinter tape from punched cards. [190]

VERIFYING

Verifying is the operation undertaken to check the accuracy of punching. Verification can be carried out mechanically by a second operation:—

- (a) using a machine which tests the punching column by column and signals discrepancies to the operator; or
- (b) repunching the same information with the cards offset in the keypunch to "ovalise" the holes where there is agreement between the first

and second punching and subsequently running the cards through another machine which detects discrepancies. [191]

Alternatively the punched cards can be run through a tabulator to produce a detailed list or totals which can be compared with the original documents or pre-determined totals. [192]

HAND VERIFIERS

Hand-verifying machines are similar to hand punches, but plungers are fitted instead of punching knives. The machine is operated in the same fashion as a hand punch but the plungers do not pierce the cards. Instead, if the key depressed corresponds with a hole in the card, the carriage travels on; if the key does not correspond, the carriage stops at the column under verification and the error can be detected by the operator. Hand verifiers are available for all three systems. One model has motorised plungers. [193]

AUTOMATIC VERIFIERS

There are two kinds of automatic verifiers:—

- (a) those developed for the Hollerith and IBM systems which are key-operated and basically similar to the hand verifiers; and
- (b) the type developed by Powers-Samas which, after cards have been punched and repunched, automatically senses the cards at high speed to detect errors. [194]

Various models of the key-operated type of machines are available [from B.T.M. Co. Ltd. and IBM Ltd.], all of which have automatic card feed and eject, programmed start and finish, blank column detection and automatic marking of cards verified. [195]

The Powers-Samas machine inserts a coloured identifying card behind each incorrectly punched card. All cards passed through the machine are automatically marked and counted. [196]

INTERPRETING

Interpreting is the operation of translating the punched holes in the card into typescript characters on the card itself. The printed information may be alphabetical or numerical. [197]

INTERPRETER

The interpreting machine is automatic and it may be set to interpret any desired part of the punched information on a card. Normally the information is printed at the top of the card, but the machine can be adjusted to print in other positions. Machine speeds are 60 cards per minute on some machines and 75 on others. [198]



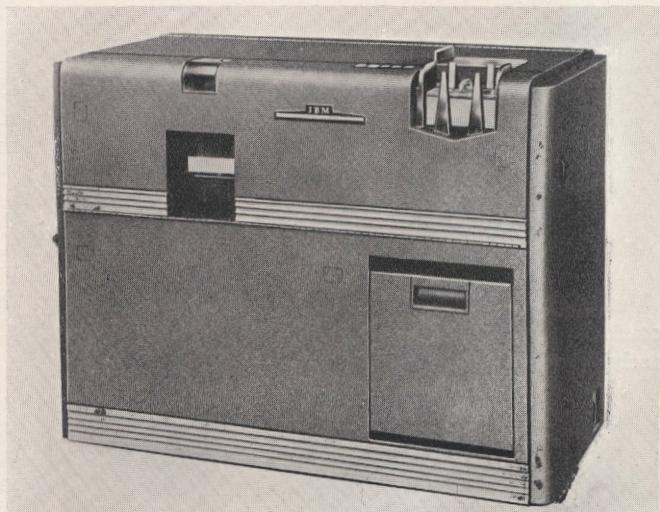
HOLLERITH AUTOMATIC VERIFIER TYPE 129



POWERS-SAMAS TABULATOR WITH SUMMARY CARD PUNCH



POWERS-SAMAS INTERPRETER



IBM CALCULATING PUNCH TYPE 602A

A special feature permits the "post" interpreting of information punched in one card on to another card.

[199]

be fitted to count the cards as they emerge from the feeding magazine, or a full counting unit which will count the holes in any or all positions in a given column of the card.

[206]

REPRODUCING

Reproducing is the process of transferring the information punched on one set of cards into another set of cards. Both alphabetical and numerical data can be reproduced.

[200]

REPRODUCING PUNCH

By appropriate settings the machine may reproduce over all fields of the card or selected fields only. Similarly, information reproduced may be transposed, e.g. information punched in cols. 1-10 of one card may be reproduced into cols. 24-33 of another.

[201]

Gang-punching may also be carried out on this machine either separately or in combination with reproduction. Some models are fitted with comparing units which permit the reproduction to be checked at the one card passage. On others a second run is necessary. Machine speeds vary from 90 to 130 cards per minute.

[202]

Special features include selective reproduction whereby information punched in one card is reproduced into selected blank fields in another partly punched card.

[203]

SORTING

Sorting is the process of arranging punched cards into the groups and sequences desired. Cards may be sorted into groups under classified headings, in strict numerical order or numerical order within classified groups. Group selection by sorting is the operation of selecting one particular group from a file of cards. It is effected without disturbing the sequence of the rest of the cards in the file.

[204]

SORTING MACHINE

In operation, the cards are placed in a feed magazine and the machine is set to sense the holes punched in the particular column of the cards representing the group desired. When the machine is set in motion, the cards are sensed individually and directed to one of 12 pockets according to the position of the hole in the card. A thirteenth pocket is provided to take those cards not punched with a hole in the column on which the cards are being sorted.

[205]

A special feature can be fitted to permit the selection of all cards containing a particular pattern of punching in a limited number of columns without disturbing the sequence of the remainder. A Veeder counter can also

Normal machine speed is 400 cards per minute, but high-speed models are available up to 666 cards per minute.

[207]

SORTING, COUNTING AND PRINTING MACHINES

These machines, which are available in the Powers-Samas range, have been specially developed for census work. Separate totals can be obtained for holes punched in any of the 12 positions in one, two or three columns of a group of cards. A count is also taken simultaneously of all cards passing through the machine. Totals are printed by operating a manual control.

[208]

A later machine, the Universal Printing Counting Sorter, provides for sub-totals to be printed automatically on the change of designation and for the accumulation of grand totals.

[209]

TABULATING

The term tabulating, used in reference to punched card machines, means broadly, the accumulating of numbers and amounts from punched cards and the printing of their totals according to the groups into which they have previously been arranged. Line by line printing of information from individual cards is known as listing. The two functions may be combined.

[210]

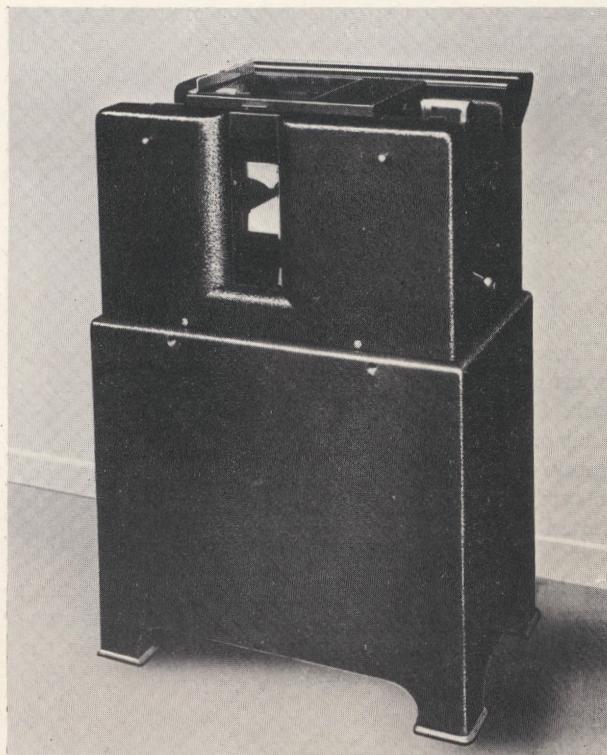
TABULATORS

The tabulator is basically an adding and printing machine. Information sensed from the punched cards is either taken into accumulating mechanisms, from which totals are transferred to the printing units at suitable intervals ("additive" information) or taken direct to the printing units ("designatory" information). An important feature of the machine is the control unit which automatically actuates the taking of totals according to changes of designations in predetermined fields.

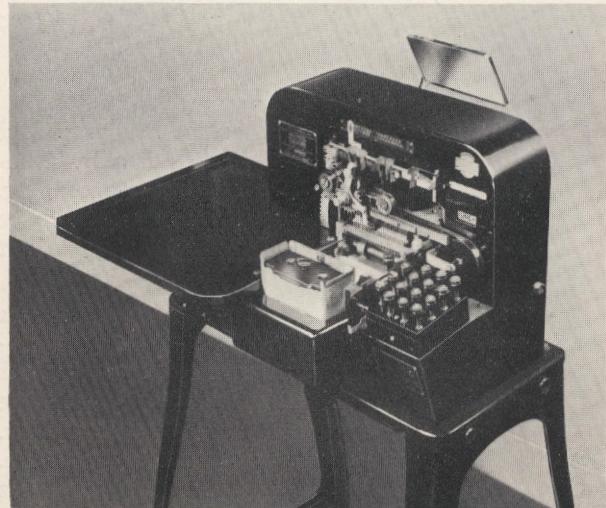
[211]

Adding mechanisms can be supplied for working in pounds, shillings and pence and also in the various units of British weights and measures. Subtracting units may be obtained and to a limited extent, supplementary calculating mechanisms. To a limited degree, additive information which requires listing under more than one head and is contained in the same field of a card, can be classified and tabulated (by means of control holes punched in the card) without prior sorting.

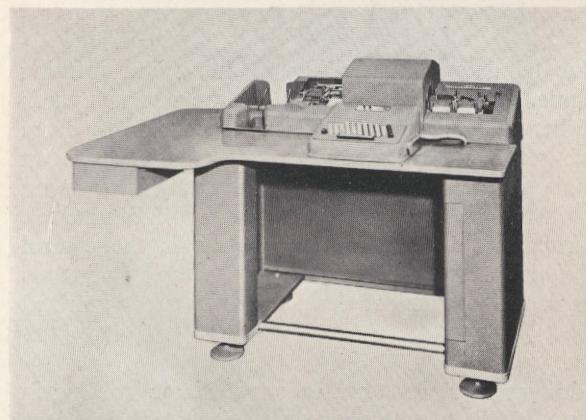
[212]



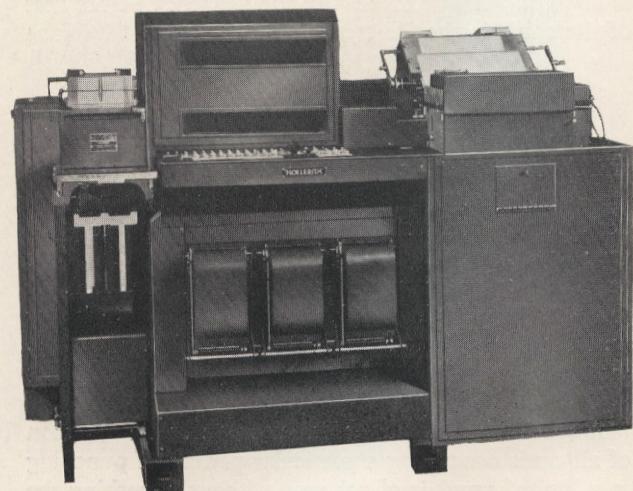
POWERS-SAMAS AUTOMATIC VERIFIER



POWERS-SAMAS UNIVERSAL AUTOMATIC KEY PUNCH



IBM ALPHABETIC AUTOMATIC KEY PUNCH



HOLLERITH ROLLING TOTAL TABULATOR

Various types of paper carriage are available so that printing may be in the form of single sheets or continuous stationery. Special devices may be specified to facilitate ledger posting.

[213]

There is, therefore, no standard type of tabulator. Specification and capacity are determined according to the needs of the job and the size of card used. The smallest machine has an adding capacity of 10 digits (sub-totals only) and a printing capacity of 25 letters or figures per line. The largest machines have adding capacities of 100 digits (sub and grand totals) and a printing line of over 100 characters.

[214]

Machine speeds vary from 80 cards per minute (alphabetical printing) to 150 cards per minute (accumulating). Additional machine cycles are used for totalling and other operations.

[215]

Within the limits of its specification, a tabulator may be programmed to carry out a number of different jobs. The machines are set up partly by the operation of manual controls and partly by the use of removable control panels (Hollerith and IBM) or connection boxes (Powers-Samas).

[216]

SUMMARY CARD PUNCHING

Summary card punching is the operation of punching into a fresh card the result of adding or subtracting figures recorded on two or more punched cards passing through the tabulator.

[217]

SUMMARY CARD PUNCH

The operation of this machine is controlled by the parent tabulator, although the summary punch is set up according to the punching layout required on the summary card. With the Hollerith and IBM systems a special dual-purpose type of reproducing punch is normally used. With the Powers-Samas system, a separate summary punch is required.

[218]

COLLATING OR INTERPOLATING

Collating and interpolating are technical terms given to the process which normally involves the comparison, card by card, of two files of cards and their association or dissociation according to the results of the comparison

and the set-up of the machine. Alternatively, comparison can be made between adjacent cards in a single file.

[219]

COLLATORS (*Hollerith and IBM*)

INTERPOLATORS (*Powers-Samas*)

These machines have a variety of uses, e.g. merging, matching, selective sorting, sequence checking. An example of their use is in the maintenance of stock records. One group of cards could record the balance in hand of a number of different items—one card for each item—while a further group of cards could record issues of the items from stock over any given period. Before the current position could be ascertained on any one item it would be necessary to associate the balance card with the related issue card or cards. It is at this stage that the machine is brought into use. Both groups of cards must be sorted into the same order. The machine will then merge the issue cards with the appropriate balance cards; and segregate all balance cards for which there are no issue cards, and issue cards for which there are no balance cards.

[220]

Machine speeds are 200 cards per minute when one feed is being used and from 200 to 400 when both are in use, according to the type of job.

[221]

CALCULATING PUNCH

The purpose of this type of machine is to carry out one or more arithmetical processes (adding, subtracting, multiplying, dividing) from data punched in a card and to punch the intermediate and final results into the same card.

[222]

Until recently machines of the relay or mechanical type only were available with speeds for the simple calculations $a \times b$ up to 25 cards per minute for a two-digit multiplier and up to 17 cards per minute for a five-digit multiplier. More involved calculations are slower.

[223]

Electronic machines now available handle $a \times b$ calculations of any size up to their maximum capacity at fixed machine speeds of 100 or 120 cards per minute. Further developments provide for medium sized sequence calculations to be completed at no less speed.

[224]

CLASSIFYING, INDEXING AND FILING

CHOICE OF EQUIPMENT

Classifying, indexing and filing systems should provide accurate and speedy reference to records. The following paragraphs give a broad description of the main types of equipment available, and may serve as a guide in deciding what system and equipment is best suited to particular needs. [225]

Before deciding the type of equipment to be used the following points merit consideration:—

- (a) the purpose of the record;
- (b) the number of individual records involved;
- (c) the frequency and extent of reference to the records;
- (d) the speed with which information needs to be obtained;
- (e) whether the system is required to signal certain facts (classification) or action to be taken (progressing);
- (f) whether statistical information will be extracted from the record;
- (g) the nature of the record, e.g. the measure of security necessary, mobility of the record;
- (h) location of the record, accommodation available and organisation of the work; and
- (i) life of the record.

[226]

The matter to be classified and filed will normally be arranged (a) alphabetically, by name, subject, etc.; (b) numerically, or (c) chronologically. These main classifications are capable of sub-division to limit the field over which reference needs to be made. For ease of reference it is customary to insert or affix suitable guides, i.e. classification labels, to mark each main and sub-classification. [227]

The equipment available for indexing and filing systems is grouped under the following broad headings:

- (a) bound books;
- (b) loose-leaf binders;
- (c) card index equipment;
- (d) strip indexes;
- (e) manilla covers;
- (f) box files;
- (g) cabinets, cupboards and racks;
- (h) posting equipment.

[228]

BOUND BOOKS

Bound books have given way generally to more flexible indexing and filing systems. For certain purposes, e.g. security, it is still found preferable to use

bound books for records. To assist reference, books may have sectional guides of stout material in distinctive colours, or thumb indexes. [229]

LOOSE-LEAF BINDERS

NON-VISIBLE BINDERS

Loose-leaf binders provide the means to house documents so that they are securely held in any order desired and yet can be easily detached. Stationery can be obtained already punched with holes, or documents may be punched as required. In either case, the holes must correspond precisely with the holding devices of the binder. Those commonly used are post, screw, ring, thong or springback. Each type of binding has particular uses, e.g. post binders for index records, thong for accounting or statistical records involving frequent posting, spring for temporary records. Ordinary non-visible binders are designed to accommodate full-length sheets to lie flat on top of each other as in a bound book. [230]

VISIBLE BINDERS

Loose-leaf binders are also designed with shorter sheets filed in such a way that when the binder is open, an edge of each form is visible. The visible edge is normally used for the classification details so that the record required is easily located. Dividers are inserted between each set of forms with provision for classification labels or tabs. [231]

Metal slip-on or adhesive signals can be affixed to the visible edges of the forms, or signalling may be effected by marking the visible edge with a coloured pencil. [232]

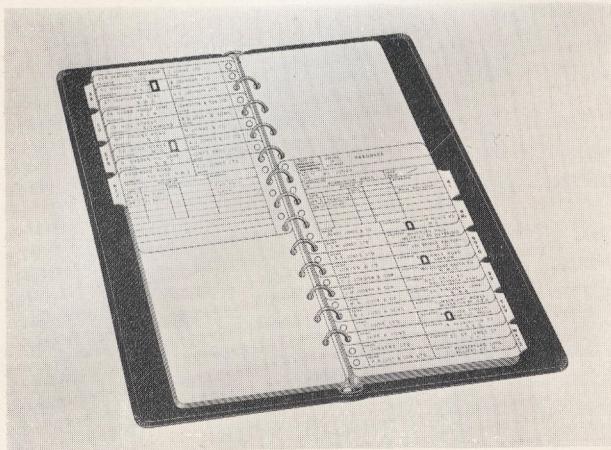
CARD INDEX EQUIPMENT

The following paragraphs describe the main types of equipment available for card records. [233]

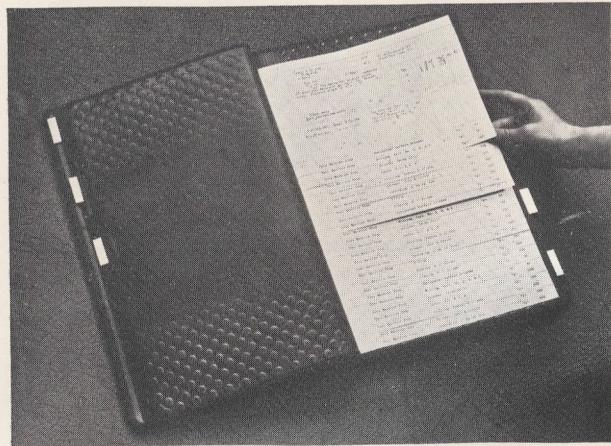
The extent to which a record will develop is not always clear when the record is first set up. For this reason it will be an advantage to install unit equipment which can easily be expanded or interchanged as the number of records varies. [234]

Cards are manufactured in several standard sizes, corresponding with the standard size equipment.

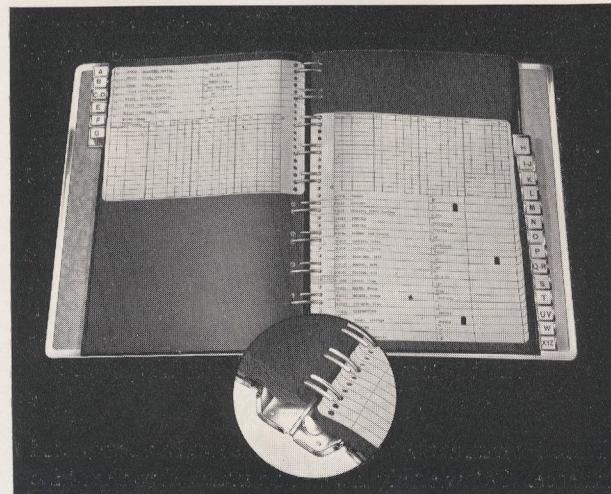
[235]



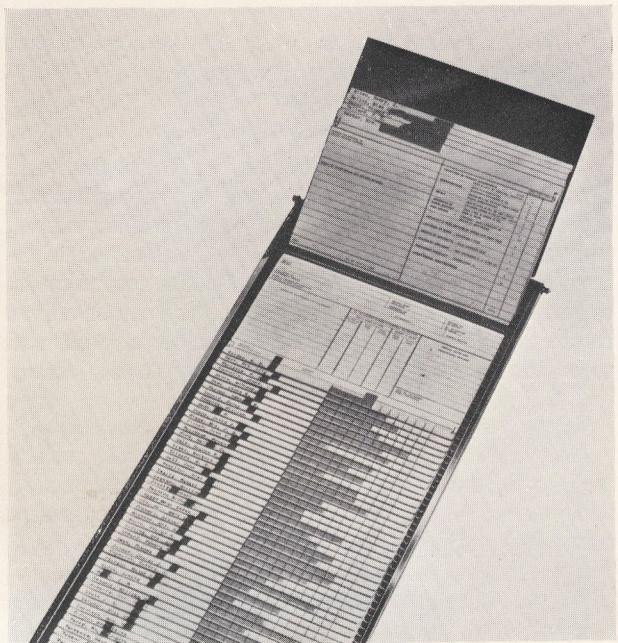
VISIBLE RING BINDER



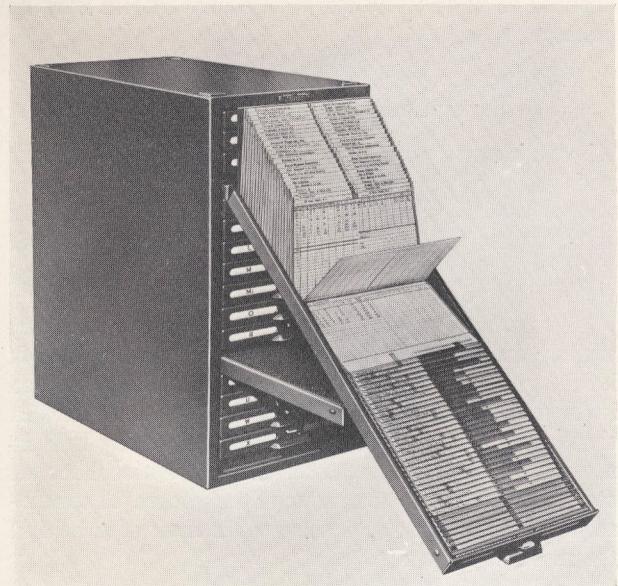
VISIBLE THONG BINDER



VISIBLE " PRONG " BINDER



FLAT VISIBLE CARD INDEX TRAY—HANGING CARD TYPE



FLAT VISIBLE CARD INDEX CABINET—POCKET TYPE

The systems of filing card records are:—

- (a) the non-visible vertical index, i.e. where the cards are filed one behind the other in an upright position; and
- (b) the visible system, i.e. where the edge of each card is visible for reference. [236]

NON-VISIBLE INDEXES

With the vertical blind index, it is essential that some form of visible signal should be used so that a particular record sought may be easily located. For this purpose, use may be made of guides or sub-classification labels inserted at appropriate prints between the record cards, or metal slip-on or adhesive signals which can be affixed to the top edges of the cards. Signals can also be used to indicate certain facts or the need for certain action. [237]

Equipment to house the cards in non-visible vertical indexes includes cardboard, wood and metal boxes, with or without protecting covers, and metal or wooden drawers in cabinets or desks. [238]

VISIBLE INDEXES

Visible card systems are of two kinds:—

- (a) flat visible; and
- (b) vertical visible. [239]

With the flat visible system the cards lie one over the other flat in the tray the lower edge of each card being exposed to view. The flat visible card system may be either:

- (a) pocket type; or
- (b) hanging card.

The usual pocket type consists of a series of stout paper pockets the top supporting edges of which extend under flanges on each side of a metal tray. The pockets can be easily inserted and extracted from the tray as required. [240]

The pocket consists of a single piece of stout paper, slightly larger than the standard size card which it holds, with a folded transparent celluloid strip fixed to its lower edge. The top corners of the card are held in slots cut into the pocket the lower edge being held in the fold of the transparent strip. An additional record card can be held in the reverse of the pocket. A supplementary record can also be inserted in front of or behind the main record card. [241]

For ease in typing a tear-off extension is provided at the lower edge of the record card, so that the title can be inserted on the extreme edge. As an alternative to typing the classification on the card, it is possible to insert separate title strips which are supplied in sheets.

As each title is typed, the strip is simply separated from the sheet and is ready for insertion under the transparent strip. [242]

A wide range of signals in different shapes and colours, with or without numbers, are available for classification and progressing purposes. [243]

In the hanging-card type the record cards are hinged to metal or wooden rods which fit under flanges on each side of the tray. The cards swivel on the holding rods so that the operator has access to both sides of the cards. A folded transparent strip can be attached over the lower edge of the card to afford protection and to hold removable signals. [244]

Cabinets used with the flat visible card system are designed to accommodate several trays, and can be fitted with a locking device. [245]

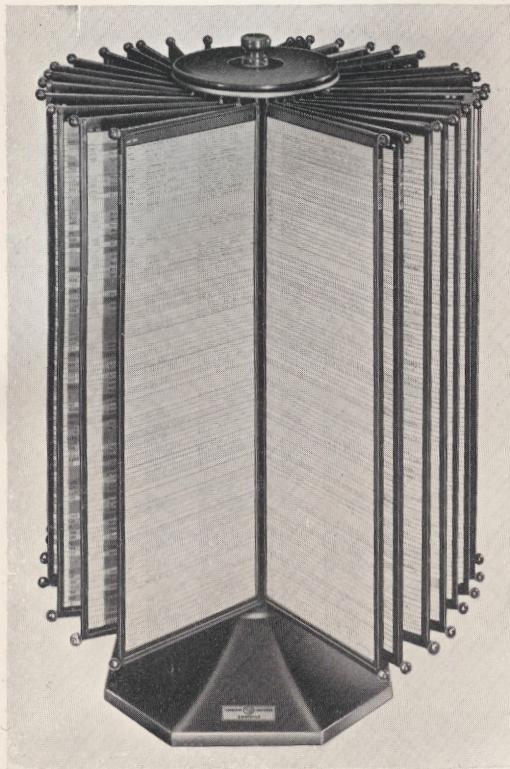
With the vertical visible system the cards are filed vertically with the right-hand edge of the card projecting beyond the edge of the card in front. The cards are slotted at intervals along their lower edge, and are filed in a drawer which has rods running from front to rear so that the cards are retained in the correct position. A divider is placed between each row of cards. The top right-hand corner of each card is cut away to provide a diagonal visible edge across which the title is typed. The cards are printed with a thick black line just below the top edge and the absence of a card is indicated by sight of the black line showing on the subsequent card. Pocket cards are available to contain subsidiary records. Coloured signals can be used to indicate classifications. [246]

STRIP INDEX

The strip index provides a flexible unit record on which only a limited amount of information is required to be recorded. The unit strips are made in a variety of lengths and correspond in depth with standard type-writer line spacing, i.e. $\frac{1}{6}$ in. or multiples of $\frac{1}{6}$ in. They are supplied in a range of colours. To facilitate typing, the strips are supplied in sheet form, each strip being easily separated from the sheet after typing. [247]

One strip index system makes use of cardboard or paper-faced laminated wood strips filed in metal panels. The metal panels are designed to hang on wall brackets, or desk or revolving stands. Another system uses paper strips filed in binders specially made for the purpose. [248]

In both systems the strips can be inserted and extracted with ease. Coloured signals can be attached to the strips or a particular classification can be indicated by coloured pencil marks. [249]



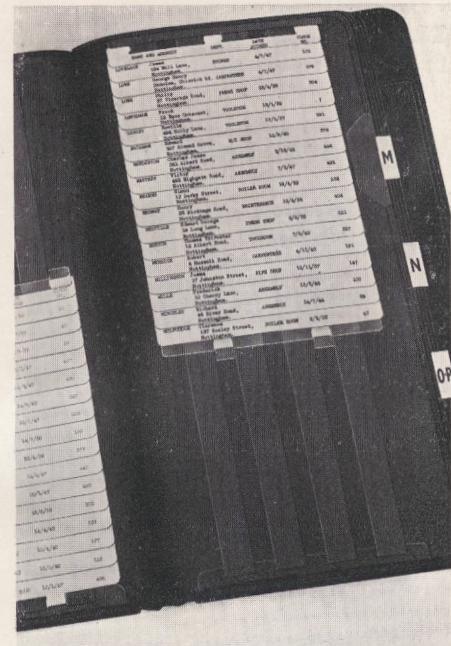
STRIP INDEX PANELS AND ROTARY STAND

CUSTOMERS RECORD	
with Signals showing Month of last purchase	
	ADDRESS
Ford & Co. <small>WARE</small>	MAN APR MAY JUN JUL AUG SEP OCT NOV DEC
Forster, A.L.	4 Knight Ltd. 37, Bethnal Green, E.C.
Guylon & Co. Ltd.	61, Golden Lane, E.C.
Harris, J.F.	145, High St., Berkhamsted
Harrison, Carr Dr. <small>W.</small>	1r. High St., Watford, Herts.
Harrison, E.	Chestnuts, Halliford, Oxshott
Henshall, A.J.	39, South Quay, St. Margarets
Holme, F.P.	17, High St., Staines
Independent <small>O.O.O.F.</small>	Bramleigh, London Rd., Haddington
Johnson & Sons	59, High St., Slough
King, Boulton & Co. <small>W.F.</small>	Riverside, Gorleston/Sea
King, Harper Ltd.	Church Rd., Stanmore, Middx.
Lambert, F.	Friar St., Reading
Lambert, F. & Sons	Greek Works, Brimstone, Bucks.
Lane's Nurseries	7, Kebble Rd., Oxford
Littman, Mr.	Berkhamsted
Len, Ltd.	Blue Tile Lane, St. Helens
Luton T.C Office	15, Water Lane, Maidstone
Mansley & Sons	Luton, Beds.
	Station Approach, Hadlett

SECTION OF STRIP INDEX PANEL



TRIPLE CARD WHEEL UNIT



STRIP INDEX BINDER

FILING EQUIPMENT

MANILLA COVERS

The style and quality of a manilla cover should be determined by the purpose for which it is to be used, for example, whether it will be an external cover or one which will form part of a set to be enclosed in another cover. The covers are available in a variety of colours, and can be obtained with or without printed titles and headings. Some are made with a gusset to accommodate bulky matter, and these and others may be made with fold-over flaps to protect the edges of the material contained. The contents are usually held in position by metal ended tags or by one of the various types of metal fasteners. [250]

BOX FILES

A box file is a shallow cardboard box with a lid similar to that of an attache case. Some are provided with a strong spring clamp under which papers are firmly held so that in whatever position the box files are arranged, whether upright in racks or flat on tables, the papers remain in position. [251]

FILING CONTAINERS

Documents are usually held in manilla folders or box files described above and these may be housed in cabinets, cupboards or open racks. [252]

There is a wide range of drawer cabinets corresponding with the standard sizes of paper forms and cards. Cabinets are not normally produced outside these sizes. The drawer may be fitted with compressor plates or fixed dividers to keep the documents upright. [253]

The drawer may be constructed so that the front may be tilted forward and the dividing partitions backwards, allowing greater space between the upper parts of the files. This secures accessibility and simple insertion or removal of papers. [254]

Cabinets can be equipped with a suspended filing system which consists of a cradle or metal frame fixed inside the cabinet drawer. From this cradle special manilla pockets are suspended by metal bars or channels attached to the top edges of the pockets. In some systems the pockets are linked and in others separate. Title

strip holders are provided fixed either vertically in slots at the top edge of the pockets or flat on the upper part of the metal channels. [255]

Cupboards and open racks are available in wood or steel. Some types have adjustable shelving. [256]

Suspended filing systems are available for use in cupboards or racks. The folders, which are made to any size, are suspended on rails. Each folder carries a transparent title holder which is visible from the front. [257]

POSTING EQUIPMENT

Posting equipment is designed to afford ease of reference to the ledger cards, and ease of removal and insertion to facilitate posting the records. [258]

There are several types of equipment. Those in common use are described below. [259]

POSTING TRAYS

Posting trays are designed to give maximum accessibility to the accounts by the use of expanding ends and sides or with ends that tilt to allow greater space for access to the ledger cards. The trays can be housed in fire-resisting cabinets which can be fitted with a locking device. Other posting trays are mounted on trolleys built to a height to suit the machine operators' requirements. [260]

VERTICAL VISIBLE

The vertical visible system of posting trays employs a series of pockets fitted vertically into panels, the pockets being arranged so that the top of the ledger card held in the pocket is visible. The panels are housed in metal cabinets which may be portable. [261]

POSTING BINDERS

Ledger cards may be housed in loose-leaf form in a locked binder. The locking mechanism is generally released automatically when the binder is set up in a special posting stand. When not in use the accounts may be filed away in fire-proof cabinets so made that the accounts lie flat. [262]

SORTING, COLLATING AND SELECTING*

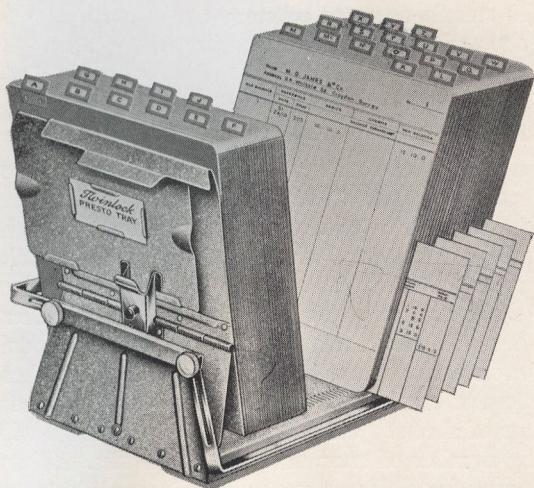
SORTING

The sorting of documents into their various classifications is a large task in many Government offices and many of the machines and fittings used have been

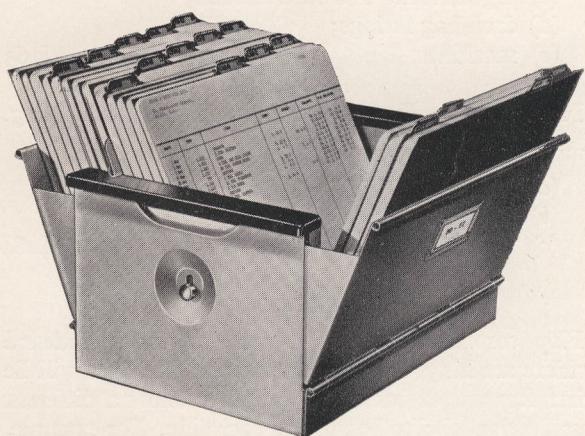
specially designed. These fall into the following broad categories:—

(a) compartments on horizontal surface;

* Further information on these subjects is provided in the booklets "Paper Collating" and "Sorting of Documents".



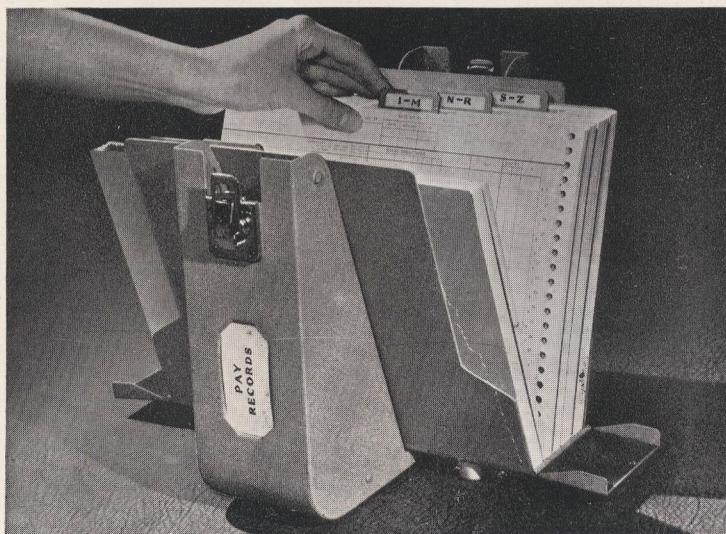
POSTING TRAY WITH POSTING MEDIA INSERTED
AND OFFSET



POSTING TRAY WITH FRONT AND BACK
EXTENDED FOR EASY ACCESS



VERTICAL VISIBLE POSTING TRAY



POSTING BOX SHOWING COVER PLACED BENEATH THE CONTAINER
TO FORM A POSTING TRAY

- (b) tiered compartments;
- (c) pigeon holes in a vertical rack;
- (d) drop bag fittings;
- (e) machines.

[263]

Proprietary appliances are also available for sorting. There are three main types:—

- (a) flap sorters;
- (b) fan-type sorting binders;
- (c) vertical sorting devices.

[264]

FLAP SORTERS

Flap sorters consist of a base to which indexed dividers are hinged at fixed intervals. The flaps will lie either forward or backward and thus allow a different classification label to be used on each side. For example, one side could be alphabetical and the other numerical. In the sorting operation, the papers are inserted behind the flap bearing the appropriate classification. [265]

The larger flap-sorter units employ moving carriages to bring each sorting flap within easy reach of the operator. These large units are available in any size needed up to a maximum of about 3600 divisions. [266]

FAN-TYPE SORTING BINDERS

Fan-type sorters consist of a series of gussetted pockets joined together. They are normally made of stout linen-backed paper, and when closed resemble large books. The pockets are much like the divisions of a brief case, and in use pull open so that the sorter becomes roughly fan-shaped. The number of pockets provided varies with different makes. Their use is confined to a small number of documents requiring a limited range of classifications. [267]

VERTICAL SORTING DEVICES

Various devices provide for sorting papers into a vertical or near-vertical position, that is, each document is held upright on one edge as in a filing cabinet. Some models enable the space required for each classification to be varied. [268]

COLLATING

As for sorting, specially-designed fittings are often used for collating documents, the commonest type being pigeon-hole racks. There are also a number of proprietary aids and mechanical devices. The aids are either portable or collapsible racks of various designs comprising separate compartments for each page set, or a series of triangular supports against either side of which a page set rests so that the operator may grasp two pages at a time with one hand. Mechanical devices include:—

- (a) treadle-operated collator;
- (b) suction-feed collator;
- (c) collating belt.

[269]

TREADLE-OPERATED COLLATOR

Treadle-operated collators consist of a vertical stack of trays each equipped with a pusher-arm with rubber-tipped fingers. The pusher-arms rest on the top of the sheets in each tray and are actuated by a foot treadle. Depression of the treadle partly ejects the top sheet from each tray and the operator then withdraws them with a single movement of the hand. Some models have two stacks of trays fitted side by side. With these the operator employs both her hands to withdraw the two lots of sheets. Various size models are made with varying number of trays and sheet capacities. Adjustable trays for different paper sizes are available. A small desk model is also made which is operated by a sliding handle instead of a treadle. [270]

SUCTION FEED COLLATOR

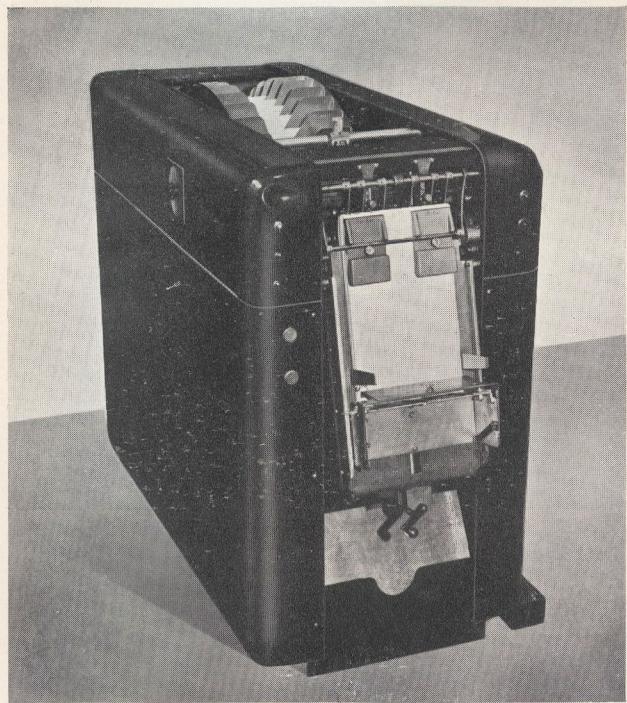
The automatic suction feed collating machine consists of a large power-driven drum with 50 pockets arranged round the circumference (similar to a water-wheel) and a paper-feed platform. As the drum rotates, a single sheet is fed into each compartment. When the drum has made a complete revolution each compartment has had one sheet fed into it. The second and subsequent sheets are then fed into the compartments in a similar manner. Fifty sets of up to 100 sheets per set can be collated in this way. [271]

COLLATING BELT

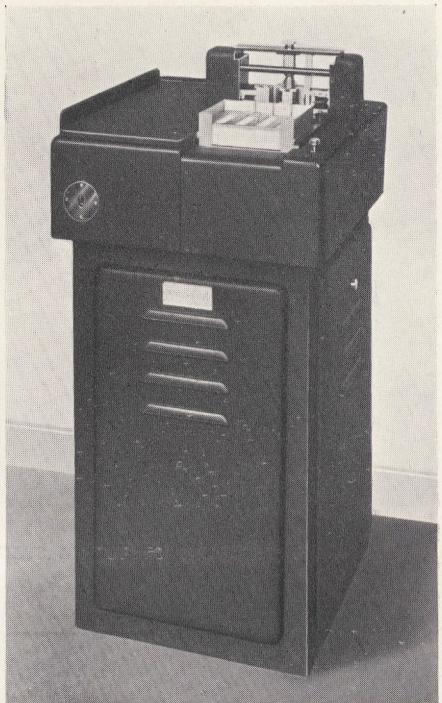
When the volume of papers to be gathered is sufficient to necessitate the employment of several operators a power-driven collating-belt may be useful. The collating-belt comprises an endless conveyor-band fitted with cleats at approximately 2 ft. intervals. Beside the belt are placed a number of tables designed to hold three piles of sheets. An operator sits at each table, gathers a sheet from each of her three piles and places them on the belt each time a cleat passes by her side. The effect is that as the cleats pass each operator the required sets are built-up and the completed sets finally removed from the belt by hand after passing the last operator. [272]

SELECTING

The Paramount and Findex selecting systems described below rely on the use of needles or rods to select a particular class of record from a number of records in punched card form. For example, in a staff index it might be required to select all record cards of men over 35 years old, with University degrees, bachelors and



SUCTION FEED COLLATOR



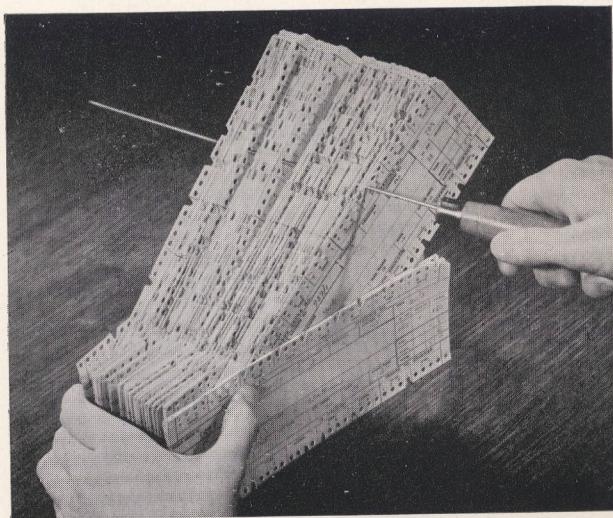
SERIAL NUMBERING AND COUNTING MACHINE



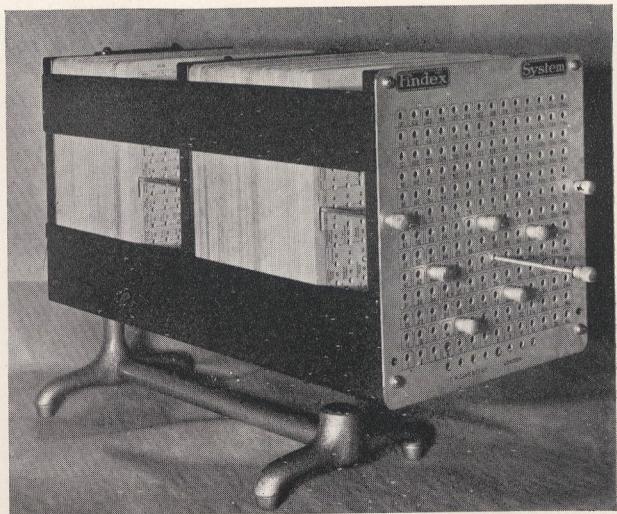
PAPER COUNTING AND IMPRINTING MACHINE



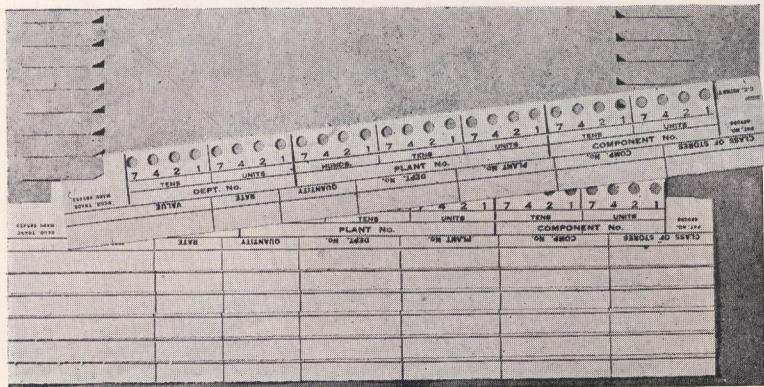
TREADLE OPERATED COLLATOR



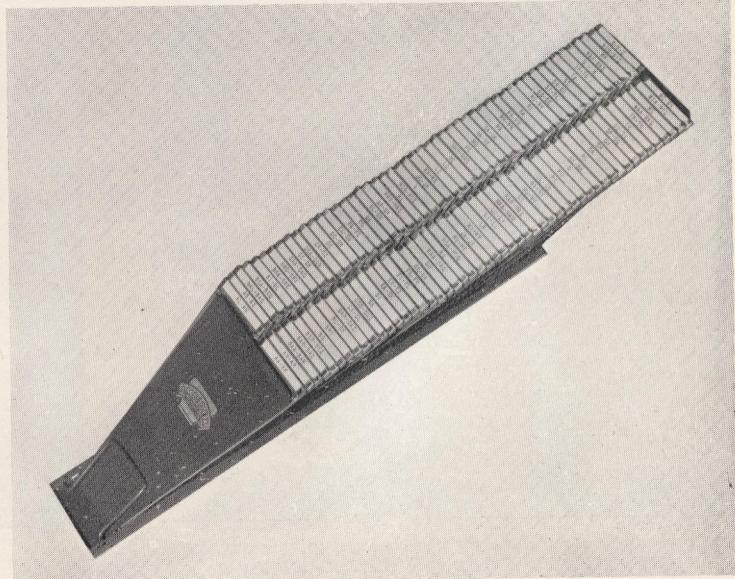
PARAMOUNT SELECTING SYSTEM



FINDEX SELECTING SYSTEM



SLIP POST SYSTEM



FLAP SORTER

living in London. Other methods of mechanical selection are described under the section concerned with punched card systems. [273]

FINDEX

In the Findex system, the cards provide space at the head for written information, the remainder being taken up with holes arranged in straight lines vertically and horizontally. The spaces between the holes arranged vertically are the classification positions, and to record information in the appropriate classification position adjacent holes are connected to form a slot. Thus any one card will have as many classification slots as there are items of information recorded on it. [274]

For the purpose of selection the cards are placed in a selection cradle having plates back and front with holes corresponding to those on the cards. Rods are passed through the metal plates into the holding slots, and other rods passed through the holes representing the classifications on which selection is to be made. The selector is then turned upside down, with the result that the cards with slots in the requisite positions drop about half an inch. A further rod is then inserted so that,

when the selector resumes its normal position, the selected cards stand above the rest. Thus, selection is made on several factors simultaneously. [275]

Cards are supplied in standard sizes of 8 in. \times 6 in. and 8 in. \times 8 in. A selecting cradle will hold up to 800 cards. [276]

PARAMOUNT

The Paramount system also provides the means to select on a variety of factors by the use of cards with a series of holes punched around the edge(s) and a selecting needle. Each hole is a position for recording a factor of information and to record information the appropriate hole is punched to convert it into a v-shaped nick. [277]

Selection is effected by passing a needle through the hole representing the recording position required and lifting the needle. Those cards with the holes intact are lifted, and those with the holes nicked out remain. The method of selection with the Paramount system is, therefore, negative. It is not normally practicable to select on more than one factor at a time. [278]

MISCELLANEOUS MACHINES AND APPLIANCES

MAIL-HANDLING EQUIPMENT

ENVELOPE OPENERS

Envelope openers work by cutting away a very narrow shaving of paper along one edge of an envelope. [279]

The machine consists of a feed-platform, a continuous feed-belt and two revolving disc knives. On most models the width of trim is adjustable and envelopes of different sizes can be accommodated. When envelope sizes differ considerably a preliminary sort is advisable. It is also necessary to ensure that the contents of the envelopes are shaken down below the depth of the cutting edge to avoid mutilating the contents. An adjustment is available on some machines to take bulky material. [280]

Hand-operated and power-driven machines are available. The machine speed varies from 3,000 to 30,000 envelopes per hour. [281]

The use of these machines is worth considering when:—

- (a) the volume of incoming mail is substantial;
- (b) the envelopes can be sorted into a few sizes; and
- (c) the contents of the envelopes are not too bulky.

[282]

TIME STAMPS

A time stamp is a stamp fitted with a clock and dating device which can also be equipped with a design-

nating die. It prints through an ink ribbon recording the time and date. The time can be shown on the basis of the 24-hour or 12-hour clock. [283]

FOLDING MACHINES

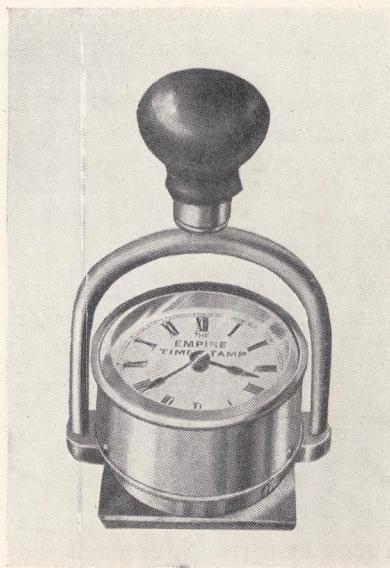
The folding machine is usually associated with the duplicating and reproducing work of the office. Junior models of this class of machine are normally employed. The machine consists of a paper-feed magazine, a hand or an automatic-friction feed, and folding rollers or plates. [284]

Most machines can be adjusted or attachments fitted to make a variety of folds, ranging from the single-fold to the more complicated accordion folds. A range of paper sizes, normally up to 12 in. by 19 in., can be passed through the machine. [285]

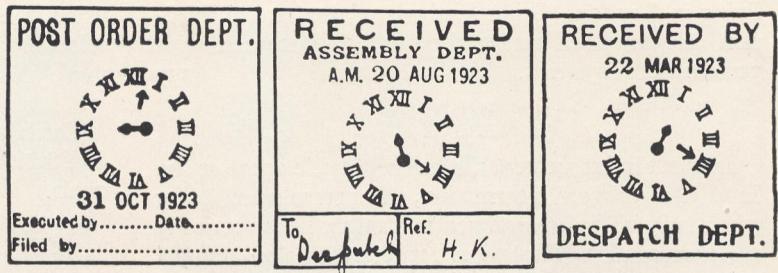
This class of machine is worth considering when large quantities of circulars, questionnaires, forms, etc., need to be folded for despatch. [286]

The folding is so accurate that it facilitates the tuck-in of documents despatched as postal folders, or the correct placing of the address when the document is despatched in a window envelope. [287]

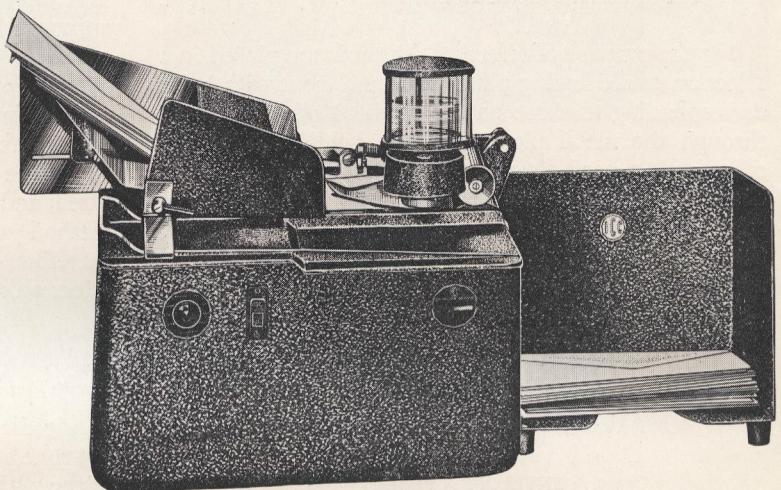
Machine speeds vary from 4,800 to 6,000 folds per hour. [288]



TIME STAMP



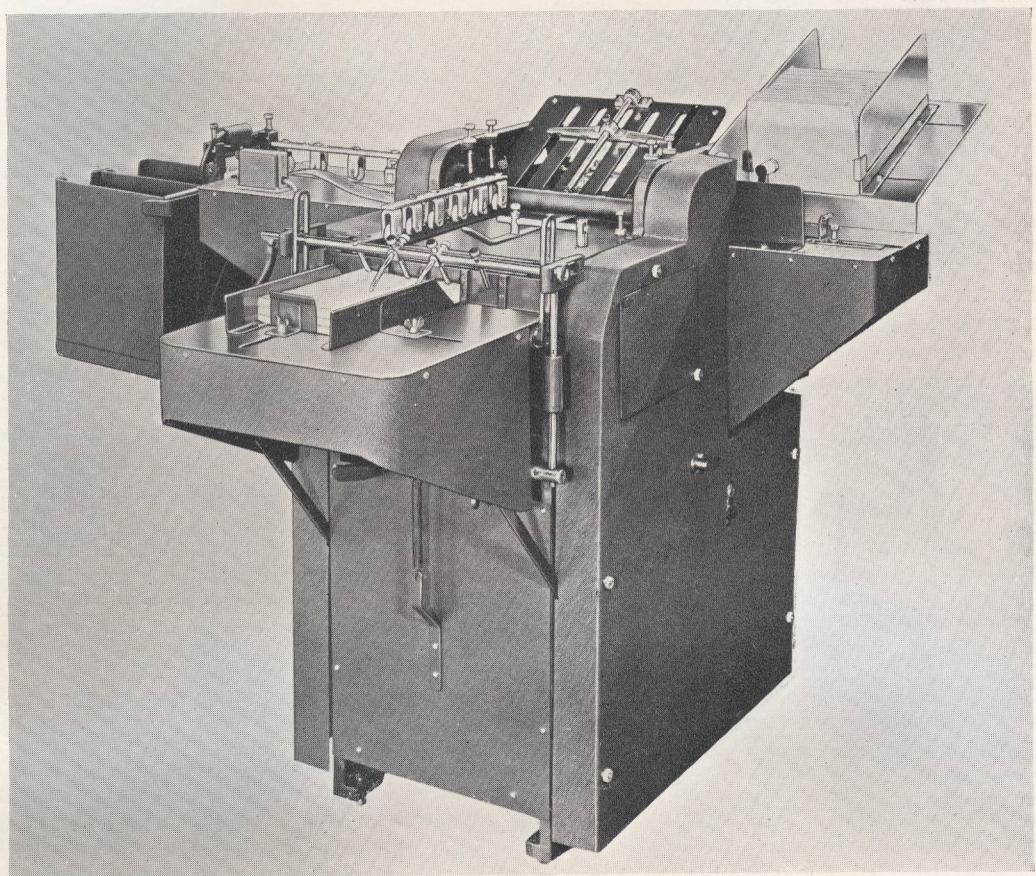
TIME STAMP IMPRESSIONS



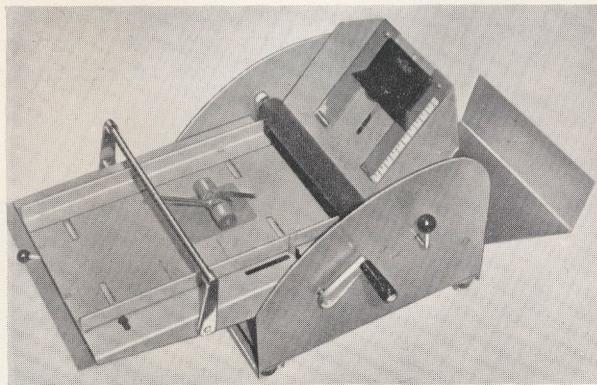
ENVELOPE SEALING MACHINE



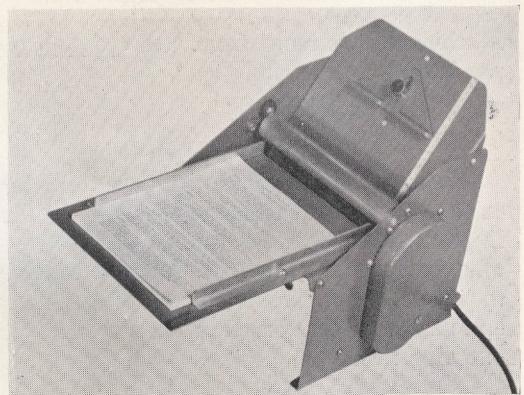
ENVELOPE OPENING MACHINE



COMBINED FOLDING, INSERTING AND SEALING MACHINE



HAND OPERATED FOLDING MACHINE



POWER OPERATED FOLDING MACHINE

WRAPPING MACHINES

The postal wrapping machine is available for wrapping magazines, catalogues and periodicals at the rate of about 2,000 an hour. The magazines are fed by hand into the machine which automatically rolls them in wrappers and deposits them into a container. An additional roller can be fitted to the delivery end of the machine to produce flat wrapping. Magazines of normal thickness up to about 14 in. x 12 in. can be rolled in wrappers up to 12 in. x 14 in. [289]

ENVELOPE INSERTING AND SEALING MACHINES

Machines are designed to insert magazines, books, etc. in an envelope. The envelopes are sealed by means of a sealing attachment which is coupled to the main machine. Other machines are available to fold documents, envelope and seal them; all operations being an integral part of the machine. Document sizes can vary from 4 in. x 4 in. to 8½ in. x 13 in. and envelopes up to 9 in. x 4 in. [290]

ENVELOPE SEALERS

There are two types of envelope sealing machines:—

- (a) those which will seal any standard size envelope; and
- (b) those which will seal envelopes of any size, shape or thickness.

Hand-operated and power-driven machines are available. [291]

The use of these machines is worth considering when:—

- (a) the outgoing mail is substantial;
- (b) the envelopes can be sorted into a few sizes;
- (c) the contents of the envelopes are not bulky.

Machine speeds range from 3,000 to 20,000 envelopes per hour. [292]

FRANKING MACHINES

Franking machines for the purpose of franking postage values do not find many applications in Government Departments. Machines can, however, be adapted for other purposes. They may be fitted with special dies to print a designation or slogan and date, for cancelling and dating incoming mail or for authorising and dating outgoing mail. [293]

The machine may also be equipped to seal envelopes. It will take documents of varying sizes and thicknesses. A counter can be fitted to record the number of envelopes or documents passed through. [294]

Hand-operated and power-driven machines are available, the latter with speeds up to 15,000 impressions per hour. [295]

CASHIERS' AIDS

CHEQUE-SIGNING MACHINES

A cheque-signing machine is used for embossing signatures on to cheques. It consists of a signature plate; a feed table; an inking mechanism; and a counting device. [296]

The signature plate is a removable block on which the signature is raised against a plain or stippled background. This plate is inserted in the machine when signature impressions are required. At other times it is kept in the custody of the signatory. Two locks are provided to guard against unauthorised use. The machine will take all cheques of standard size. [297]

Hand-operated and power-driven machines are available. Machine speed is approximately 1,500 signatures per hour for the manual model and 5,000 per hour for the electric. [298]

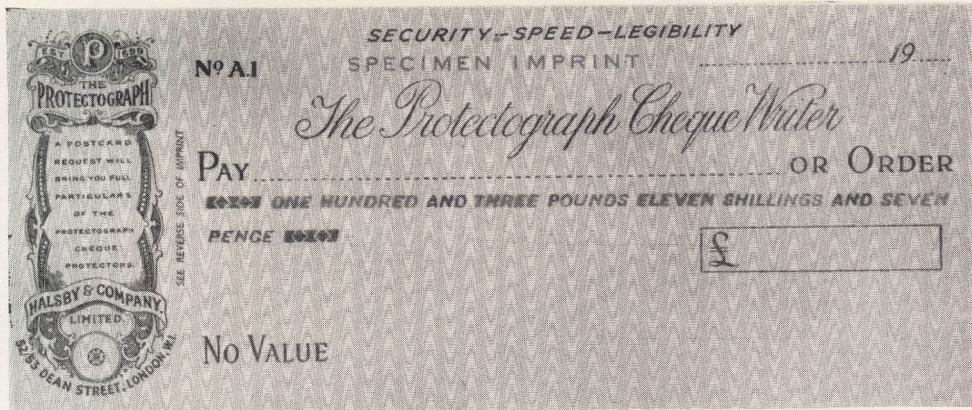
CHEQUE-WRITING MACHINES

The cheque-writing machine writes the amount in figures or words. The amount is set up by means of a slide or lever. On one model the date can also be set up. The cheques are placed in a slot and the amount extended on it by a process which crimps the surface of the paper and makes alterations very difficult. On some models a signature or other description can appear as a prefix to the amount. [299]

RECEIPTING MACHINES

Receipting machines are used as cashiers' aids so that in the process of issuing receipts, the subsequent work of balancing and the bringing to account may be facilitated. Accordingly, the requirements of a receipting machine are:—

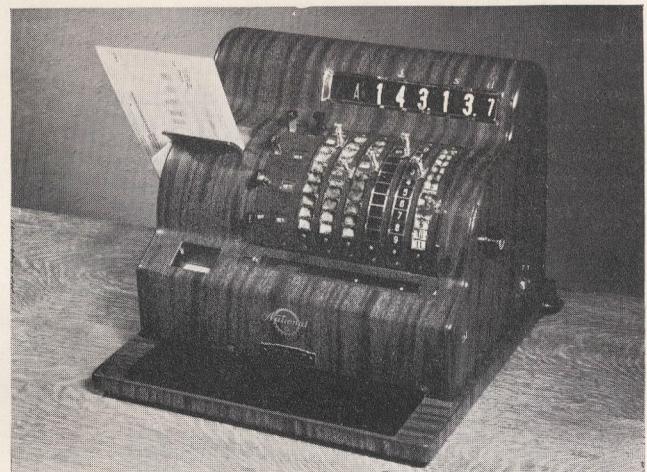
- (a) to issue a receipt quickly;
- (b) to provide a legible receipt;
- (c) to promote rapid cash balancing by the provision of automatic, correct totals of the amounts stated on the receipts;
- (d) to provide accurate and legible posting media;
- (e) to give analysis totals which may be rapidly brought to account;
- (f) to ensure that the same amount is recorded on the receipt, posting media and any other permanent record and that these records may be easily audited; and
- (g) to give adequate safeguards. [300]



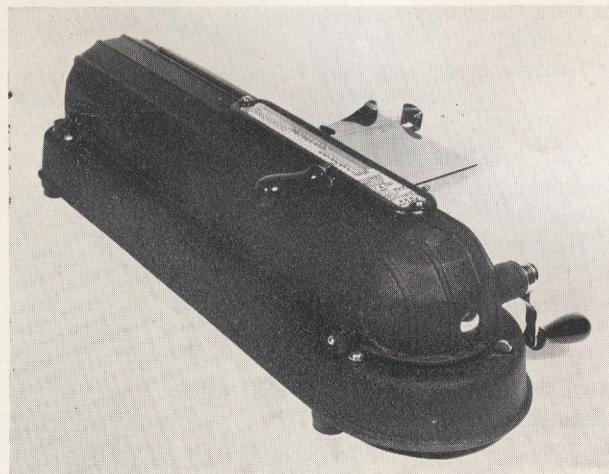
SPECIMEN CHEQUE ON WHICH THE AMOUNT IN WORDS WAS RECORDED BY MACHINE



RECEIPTING MACHINE BASED ON THE ADDING LISTING MACHINE



RECEIPTING MACHINE BASED ON THE CASH REGISTER



CHEQUE WRITING MACHINE

Receipting machines are a development of either adding listing machines or cash register machines. Both types provide a locked audit tape list of the transactions recorded and locks for preventing misuse of the machine or of the date mechanism or such other functions required to be controlled. They are fitted with a front feed or a chute feed to facilitate insertion of forms. [301]

One simple type of receipting machine is based upon a two-register adding listing machine so that two totals may be obtained; say (a) for payments by cash (b) for payments by post; or again for two clerks using the same machine. Another simple type based on the cash register allows for four totals to be obtained giving a larger degree of analysis. There is a larger machine, which can also be used as an accounting machine and which can have up to 27 registers giving a more comprehensive analysis of receipts. [302]

In considering the use of receipting machines the design of the forms is important. It is an advantage to allow for the receipting of the original bill and if posting media are required, to design the original bill with a tear-off posting stub. [303]

COIN AND NOTE MACHINES

COIN-ISSUING MACHINES

Coin-issuing machines are of two types:—

- (a) a machine designed for giving change; and
- (b) a machine designed for the issue of coin, for the making up of wages, etc.

[304]

The change-giving machine combines the function of change-giving and coin-issuing. It has a compact keyboard in two sections each with distinctive coloured keys. The keys in one section are used for giving change where coins are tendered, the amount of change having to be calculated. When a 10s. note is tendered, the cashier presses the appropriate keys in the other section for the amount of purchase, and the machine delivers the correct change. [305]

The wage-paying machine consists of a keyboard with keys for every value up to 9s. 11d., and a removable coin tray. Spare coin trays are available to save time in reloading the machine. The depression of a key causes the coins to pass down a chute direct into a pay envelope or direct into the hand. [306]

Machines will hold from £20 to £35 in silver and the reserve tray an additional £50. Large capacity storage trays are obtainable. Any column of the storage tray can be refilled from the reserve trays. [307]

COIN-SORTING MACHINES

Coin-sorting machines sort mixed coin by size into its various denominations. The machines consist of a series of trays, or sieves, one above the other, each having holes or slits graduated in size from the largest in the top to the smallest in the bottom tray. The mixed coin is placed in the top of the machine and is shaken down, by hand or automatically, and is retained or passed on according to the size of the holes or slits in each successive tray until each coin reaches the tray appropriate to its denomination. [308]

COIN-COUNTING MACHINES

Coin-counting machines count and record the various denominations of coins. Totals, and sub-totals if required, are recorded in pounds, fractions of a pound are recorded as so many half-crowns, florins, etc. Where it is required to count out a certain sum, e.g. in payroll, there is a control lever to stop the counting mechanism at a predetermined point. There are models to count coins of one denomination only at a time and others to count mixed coin. Some models are also equipped to sort coins to pouch them or to pack coins in rolls. The machine speed is up to 90,000 coins per hour. [309]

NOTE-FOLDING MACHINES

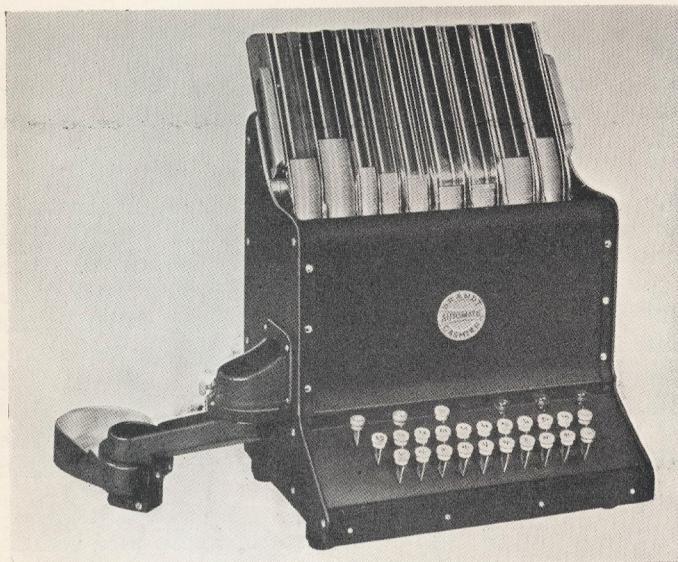
There are machines which fold Treasury notes in a variety of folds. Some fold both new and used notes; others take new notes only. A counter may be fitted to record the number of notes passed through the machine. [310]

The speed of these machines is up to 4,000 folds per hour. [311]

COUNTING AND NUMBERING MACHINES

Various types of machines are available for counting or numbering and counting. [312]

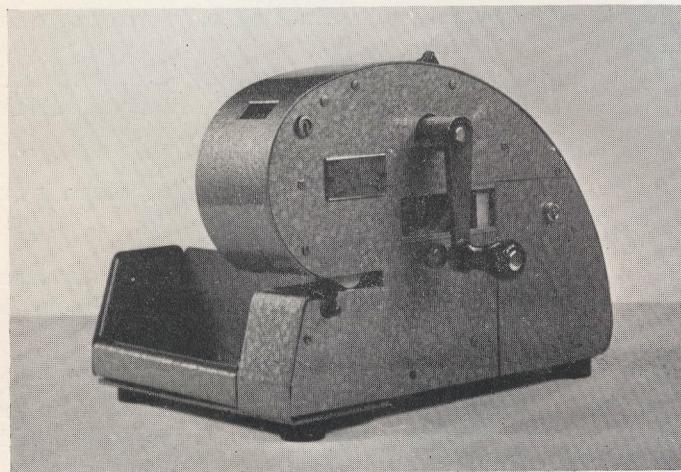
A counting machine with a speed of 30,000 to 60,000 per hour is available to count documents and can be adjusted to any size of paper between 2 in. \times 2 in. and 5 in. \times 8½ in. in any thickness from .003 in. to .015 in. The quantity counted is recorded on two counters; one which records the individual batch count and is set back to zero by hand; the other records the cumulative total up to 99,999,999 then automatically returns to zero. Optionally the machine can be fitted to date, code, cross, endorse, or otherwise imprint each document counted. [313]



COIN ISSUING MACHINE



INSURANCE FRANKING MACHINE



STAMP AFFIXING MACHINE

A high-speed paper-numbering machine is made to print consecutive numbers on sheets which are automatically fed into the machine at a speed of 12,000 sheets per hour. The numbering device automatically cuts out if feeding is interrupted. [314]

There is also another type of numbering and, optionally, combined endorsing machine which is fed by hand. Although this machine can be used on its own for counting papers of different thickness and size up to a maximum width of $10\frac{1}{2}$ inches, it is primarily designed for use in conjunction with the microfilm camera. After numbering, the documents are carried forward automatically into the camera. [315]

INSURANCE STAMP MACHINES

STAMP-AFFIXING MACHINES

The machine performs in one operation the actions of separating a stamp from a roll of stamps, moistening and affixing it to an insurance card and cancelling the stamp with an inked impression of the date. An adjustable gauge in the base ensures that the stamp is affixed in the space appropriate to the week. The machine is loaded with a roll of 480 stamps and a counter records the number used. [316]

INSURANCE STAMP FRANKING MACHINE

The machine employs dies to make a franked impression on the cards. The dies for each stamp value are contained in separate interchangeable units each with a counting device. The counters in the units are set by the Ministry of Pensions and National Insurance to give a number of impressions according to the amount of deposit paid. [317]

A permit must be obtained from the Ministry of Pensions and National Insurance before this machine may be used. At the end of each contribution year the employer must surrender all the impressed cards due for exchange to a designated local office of the Ministry. [318]

DICTATING AND RECORDING MACHINES

Dictating machines record the voice of a speaker for subsequent reproduction for transcription by a typist. Wax cylinder equipment which had served this purpose for half a century is being rapidly superseded, chiefly by magnetic recorders. With the older machines the wax cylinder was inscribed with a fine channel by the cutting jewel on the dictating machine. A second machine was necessary to play back from this recording to the typist and a third machine was used to restore a smooth

surface to the cylinder by shaving away the inscribed recording. Each cylinder could be used about fifty times. The early wax cylinder machines were acoustic, but electronics were applied to later models to improve the quality of the recording. [319]

Two variations of the inscribing method of recording are now in current use. One of these uses a thin plastic belt in place of the wax cylinder, the belt being used once only and then discarded. The other uses a plastic disc on which the recording is impressed rather than inscribed; the discs can be reconditioned and re-used five or six times. [320]

Magnetic recorders are tending to replace these earlier forms of dictating machine mainly on the grounds of economy since, in particular:

- (a) the same basic machine can be used both for recording and reproduction; and
- (b) the recording media can be used an indefinite number of times; its life being dependent upon physical wear and tear. [321]

The recording medium may be either a paper or plastic disc, sheet or tape, coated with a magnetic iron oxide; or a fine gauge steel wire. [322]

In magnetic recording, sound is converted into magnetic energy by an electro magnet in the recording head and causes the iron oxide particles to align themselves with the field set up. In playing back the magnetic variations of the recording surface moving past the coil of the pick up, induces minute electric signals. These signals are amplified and applied to a loudspeaker or headphone to reproduce the original sound. [323]

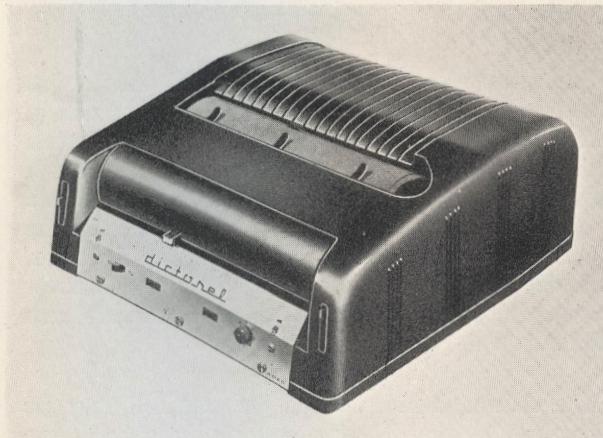
Since the recording consists of a rearrangement of the surface of the medium it follows that the recording can be eliminated either by:—

- (a) restoring the original arrangement, for example, by passing a permanent bar magnet over the recording surface; or
- (b) imposing a fresh recording on the medium resulting in a completely new arrangement of the surface particles. [324]

Thus since there is no cutting of the medium it can be used over and over again. [325]

For ordinary office dictation the coated disc or paper sheet recorders are generally more suitable on the grounds that:—

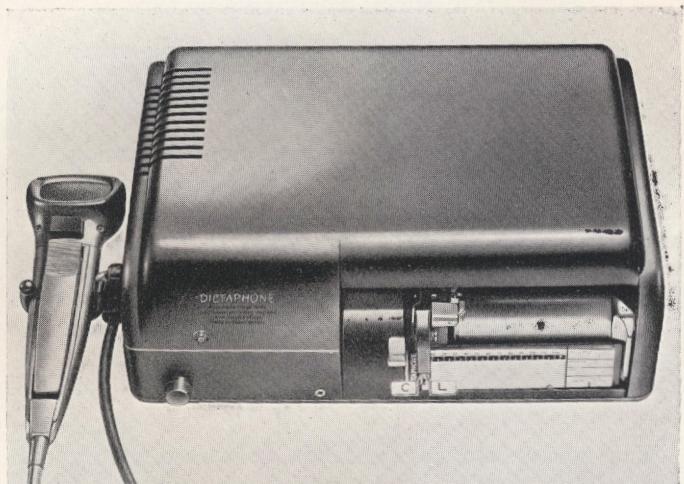
- (a) it is possible to move the pick-up head directly and fairly accurately to any point in the recording; this is essential for dealing with difficult corrections;



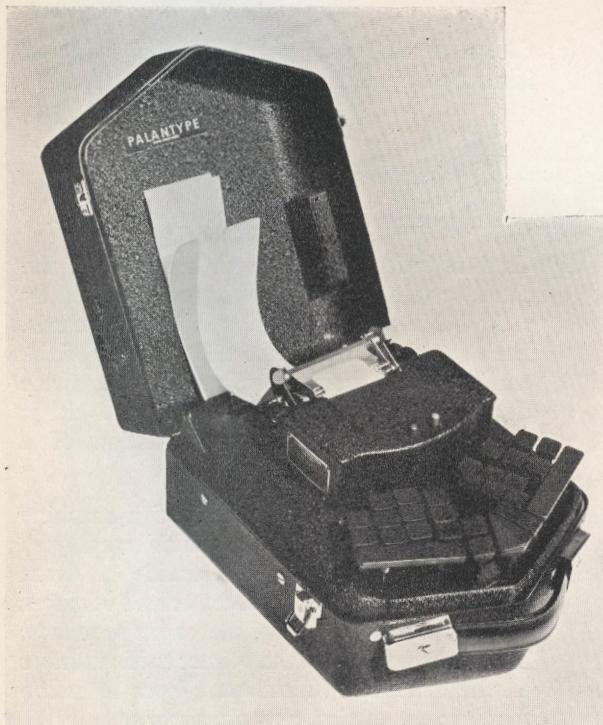
DICTATING MACHINE RECORDING MAGNETICALLY
ON A PAPER SHEET



DICTATING MACHINE RECORDING MAGNETICALLY
ON A PLASTIC DISC



DICTATING MACHINE RECORDING ON A PLASTIC BELT



STENOTYPE MACHINE

- (b) it is possible to adjust the speed of playback to facilitate transcription; and
- (c) on tape and wire recorders it is necessary to wind back the tape or wire before it can be played back.

[326]

Although dictating machines produce obvious economies there are many factors that determine whether dictating machines should be installed. A dictating machine is especially suitable when:—

- (a) the work calls for immediate dictation with the subject fresh in mind and there is no shorthand writer available;
- (b) the work has to be done outside the normal working hours of shorthand writers;
- (c) dictation is likely to be interrupted with consequent loss of time to a shorthand writer;
- (d) the office is remote from shorthand-writer service.

[327]

The best is not likely to be obtained from a dictating machine installation if it is treated only as a fall back for times when a shorthand writer is not available. Regular use of the system leads to greater speed and effectiveness on the part of the dictating officer no less than of the transcribing operator. Both need training at the outset. In favourable conditions transcribing can be done more quickly, and with less strain, than typing from a draft.

[328]

Few officers have sufficient suitable work to justify the exclusive use of a dictating machine and some method of sharing will often have to be evolved. Even with a system of sharing, however, it is not possible for all potential users to have ready access to a machine and some at least will resort to manuscript drafting. A number of systems have been designed to permit the holding centrally of a small pool of dictating machines accessible by telephone to all potential users so securing the maximum economy in the use of dictating machines. Such systems, however, can usually only be applied where a private internal telephone system exists. [329]

Tape recorders are generally better suited to the recording of any lengthy proceedings which necessitate a true verbatim record and for some instruction and training work. For most committee meetings a verbatim record would usually contain much unnecessary detail which would waste the time of the reader or listener. A verbatim record does not therefore, and should not be used, to take the place of properly constructed minutes.

[330]

STENOTYPE

The stenotype is a machine for the mechanical recording of a particular system of shorthand which, instead of symbols, uses combinations of the letters of the alphabet and certain phonetic symbols. It has a keyboard on which the initial consonants of a syllable or single-syllable word are grouped on the left, the vowels in the centre and final consonants on the right. Each depression of the keyboard records on a narrow strip of paper (a tally roll) a syllable—one line to each syllable.

[331]

The shorthand recorded on the tally roll may be transcribed by the operator, or a copy typist; in the latter case the typist would need to be trained to read the particular system of shorthand used in the stenotype machine.

[332]

TIME-RECORDING CLOCKS

Time-recording clocks used in offices and works fall into three main classes.

- (a) Attendance clocks for recording on a card or other document the times of arrival and departure of employees.
- (b) Job clocks for recording the time spent in a manufacturing process or other job where it is required to have an accurate and permanent record.
- (c) Clocks to check the carrying out of tours of inspection by nightwatchmen, firemen, etc.

[333]

ATTENDANCE CLOCKS

There are four main types of gate clocks in use:—

- (a) Card recorders are generally situated at the entrance to an office or factory and flanked by racks holding the employees' individual cards. Each card bears the name and number of the employee, and on insertion into the attendance clock the time is recorded on the card either automatically or by the manipulation of a lever.
- (b) Radial time recorders, consist of a machine which has a large dial on which employees numbers are marked, and, inside a drum around which there is a sheet or roll of paper bearing the numbers in the same sequence. The employee rotates the pointer to his number on the dial and manipulates a lever to stamp the time automatically on the paper.

(c) Key recorders are operated by keys, each key bearing an employee's number. The keys are stored in a rack near the recorder, and on arrival and departure, the employee inserts and turns his key, causing the number and time to be inserted on a tally roll inside the clock.

(d) Signature clocks, by manipulation of a lever, register the time on a tally roll locked inside the clock, and simultaneously expose a section of the tally roll on which the employee signs his name. [334]

JOB CLOCKS

Job clocks are small portable clocks into which a single job card or ticket is inserted by the operator or timekeeper to record the times of starting and finishing a job. [335]

INSPECTION CLOCKS

An inspection clock is a portable type of key recorder. It is carried by the watchman on his tours of duty. At various points on his rounds there are keys in locked containers; the watchman inserts the key into his clock and the time is automatically recorded on a tally roll in the clock. [336]

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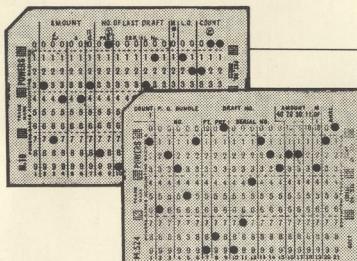
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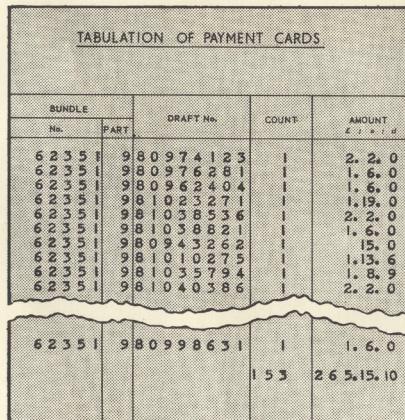
THE CONTROL OF POSTAL DRAFTS

NOT NEGOTIABLE MINISTRY OF NATIONAL INSURANCE		POSTAL DRAFT		6	974123						
To the POSTMASTER PAY <i>T. Hicks</i>		THIS DRAFT WILL BECOME VOID UNLESS PRESENTED FOR PAYMENT AT A POST OFFICE WITHIN THREE MONTHS OF THE DATE OF ISSUE.		80							
In respect of SICKNESS FROM <u>26/3/32</u> TO <u>3/3/32</u>		<p>K.R. NUMBER KT 1302985 C</p> <table border="1"> <tr> <td>POUNDS</td> <td>SHILLINGS</td> <td>PENCE</td> </tr> <tr> <td>TWO</td> <td>TWO</td> <td>0</td> </tr> </table> <p>NOT EXCEEDING FIVE POUNDS</p>		POUNDS	SHILLINGS	PENCE	TWO	TWO	0	<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
POUNDS	SHILLINGS	PENCE									
TWO	TWO	0									
under the National Insurance Act.											
		<p>H. W. AYERS, Assessment General, Ministry of National Insurance <i>T. Hicks</i></p>									
<p>RECEIVED the above-named sum For Registration—see back</p>		<p>ISSUING OFFICE STAMP WITH DATE.</p> <p><i>3/3/32</i></p>									

1



2



4



Postal drafts (1) are issued by Local National Insurance Offices in numerical order. Carbon copies are sent to Newcastle, and from these an "Issue" card (2) is punched for the total of each run of approximately 200 drafts.

As the drafts are cashed at Post Offices they are sent in bundles by G.P.O. Clearing House to Newcastle, where a "Payment" card (3) is punched for each draft. The Payment cards are tabulated (4) and any discrepancy between the total and the G.P.O. claim is cleared.

Drafts are put away unsorted in their original bundles, but to facilitate tracing individual drafts, the Payment cards (which contain the Bundle number) are sorted at this stage as far as the 10,000 digit of the serial number.

When it is desired that virtually all drafts issued in a particular month will have been cashed, sorting of Payment cards to strict numerical order is completed, the Issue cards being sorted in simultaneously so that each falls at the end of the group of Payment cards to which it relates. The cards are tabulated (5) to show the value of each group of Payments with the value of the corresponding Issues printed adjacently. This tabulation reveals any discrepancies, which are investigated; provides totals for aggregation for book-keeping purposes; and also provides a standing index as it shows the bundle in which any draft can be found. Printing of the last digit of the draft number in a zig-zag enables uncashed drafts to be located rapidly by inspection.

Finally, Payment cards are sorted by Benefit code and tabulated to give an analysis of expenditure by type of benefit.

FINAL BALANCING TABULATION						
BUNDLE		DRAFT NO.			AMOUNT	
No.	PART	1	2	3	4	5
522117	9	974	1	2		1. 6. 0
5222071	1	974	2	1		16. 0
51831	6	974	1	2	2	16. 0
623351	9	974	1	2	3	2. 2. 0
5033501	1	974	1	2	4	1. 8. 0
5133801	2	974	1	2	5	2. 2. 0
5206691	7	974	1	2	6	8. 6. 0
50341	1	975	1	2	7	2. 9. 6
5206691	8	975	1	2	8	2. 4. 0
50903	1	974	1	2	9	1.13. 6
53624	4	974	1	3		16. 0
506203	1	974	1	3		1. 2. 4
502344	2	974	1	3	3	1.10. 3
50828	3	974	1	3	4	2. 2. 0
53210	4	974	1	3	5	1.16. 0
53806	5	974	1	3	6	10. 6
996261	6	974	1	3	7	2. 2. 0
	7	974	1	3		2. 2. 0

**Group T
(Issue 1)**

— Break in stagger line indicates outstanding draw

No amount printed
Indicates a spot
or cancelled draw

Group Total
(Payment Card)

5 2 6 3 4	4 9 7 4 3 1 9	1 16. 0
3 4 7 4	3 9 7 4 3 1 9	3 4 3. 8. 2

The difference between the two totals is normally accounted for by outstanding drafts.

STATISTICAL STATEMENT
PREPARED ON AN ALPHABETICAL TABULATOR

THE PRODUCTION OF PERIODIC SUMMARIES FROM WEEKLY LISTS

This illustrates the posting of Stock Ledger Quantity balances by a Tabulator.

A Stock Issue card (1) is punched for every item on the Delivery Note (2). Weekly a listed statement is prepared (3) and for the total quantity shown against every Group and Item a summary card (4) is automatically punched. These summary cards, together with the receipts, are listed each quarter for the quarterly balances of stock.

CALCULATION OF LOAN REPAYMENTS AND PRODUCTION OF LEDGER ACCOUNTS AND DEMAND NOTICES

THIS IS AN ILLUSTRATION OF THE METHOD USED BY THE PUBLIC WORKS LOAN BOARD

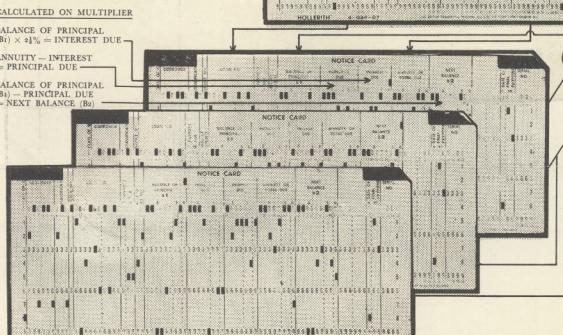
New Loan Cards (1) are hand-punched from the documents (2) and are used to print the headings of the loan accounts (3) and to provide the basic information for subsequent calculations throughout the period of the loan without further hand-punching.

A Notice Card for the first half-yearly repayment (4) is reproduced from the New Loan Card and the details of the repayment are calculated on the Multiplier. From this card a further Notice Card for the second repayment (5) is reproduced and this process is continued for as many repayments as may be necessary. The details of the repayments are then printed on the loan account.

Pre-punched Name and Address Cards (6) are sorted in with the Notice Cards to enable the Demand Notices (7) to be prepared.

The New Loan Cards are available for producing such statistical statements as may be required.

PUBLIC WORKS LOAN BOARD		Date approved	15/7/53	Subscribing Authority	M. of H. & L. C.	Address	10,000
Act.	Yankee	Mortgage	Assume	Dated	29/7/53	Total Loan	45,000
Borrower	Reddick, V. D. C.						
Repayment Date	7 th February 7 th August						
1 Class of Card	8						
1-2 Borrower No.	207,007						
8-10 CLASSIFICATION	3 B						
11 Note No.	0						
12-17 MORTGAGE REIF. No.	144,026						
18-21 Loan No., Suffix	0601						
22-24 Date of 1st Payment	1-54						
25-26 RATE OF INTEREST %	6 1/2						
27-28 AMOUNT OF ADVANCE	10,000						
28-29 ENTRANCE OF PRINCIPAL	4						
34 Type of Borrower	5						
45-50 MORTGAGE NO. (see top r.h.s.)	231-7						
50-58 AMOUNT	2,500						
59-64 DATE OF ADVANCE	15/7/53						
65-67 Days to First Payment	6 weeks						
68-70 Date of Approval	53(2)						
74-76 Date of Final Payment	AUG 2013						
77-80 MONTHLY/HALF-YEARLY							
78-84 PERIOD OF REPAYMENT, YRS.	60						
LOAN No.	194,016						
LOAN OR PART OF LOAN	45,000						
AMOUNT OF CONSENT	45,000						
DATE OF CONSENT	18/7/53						
Per 4	* Land						
P.W.L.B. 1 of 2							



MURDOCK MFG. CO. LTD. A. & P. M. LLC. 409-409									
Mishawaka, Ind. C.									
CERTIFICATE NO.	DATE OF ADVANCE	AMOUNT OF ADVANCE (IN MILES)	REPAYMENT AMOUNT (IN MILES)	PERIOD YEAR	DATE OF FINAL PAYOUT	DUE DATES	CLASSIFICATION	LOAN NO.	BORROWER NO.
									60
5540	07 08 53	10000	8	231. 0.7	BATE 1.00 ADDITIONAL 4 1/4	1 348	7 Aug.		
		DATE DUE	BALANCE OUTSTANDING (IN MILES)	PRINCIPAL (IN MILES)	INTEREST (IN MILES)	TOTAL (IN MILES)	DATE OF PAYMENT	REMARKS	
1	5 4	10000. 0.0	18. 10.7	212. 10.0	231. 0.7				
1	5 4	9981. 3.5	18. 18.6	212. 2.1	231. 0.7				
1	5 5	9962. 10.11	19. 6.6	211. 14.1	231. 0.7				
2	5 5	9943. 4.5	19. 14.9	211. 5.19	231. 0.7				

THE CLERK TO THE URBAN DISTRICT COUNCIL COUNCIL OFFICES MIDCHESTER						PUBLIC WORKS LOAN BOARD, BANK BUILDINGS, 19, OLD JEWRY, LONDON, E.C.2.						
MIDCHESTER U.D.C						22 DEC 1953						
NOTICE is hereby given that on the 7 FEB 1954 the Cashiers of the Bank of England are hereby requested to receive and place to the Credit of "THE Public Works Loan Account". Payment should be made direct to the Cashiers of the Bank of England, Threadneedle Street, London, E.C.2, accompanied by this Notice, and NOT TO the Public Works Loan Board. Drafts should be made payable to the order of "THE BANK OF ENGLAND" and crossed "BANK OF ENGLAND". Postage must in all cases be prepaid. This demand notice, duly received, will be returned to you.						207001 202						
						J. W. ROBERTS, Secretary.						
						Total Due						
Loan No.	Balance Outstanding			Principal in Payment			Interest on Payment					
	£	£	£	£	£	£	£	£	£	£	£	
0 8 4 2 6 1 0 3 0 3	6 5 4	9 1		1 0	7 2 4		0	0	0	1 5	1 1 1	
0 8 6 2 4 9 0 0 0 1	1 6 4	2 7	18 0	7 3	5 7		2 0	0	0	2 4	1 2 1	
0 8 6 2 4 9 0 6 0 2	1 7 0	8 2	19 5	7 6	17 4		2 1	1 0	9	2 9	0 8 1	
0 8 6 2 4 9 0 6 0 3	1 7 3	5 9	18 5	7 7	17 4		2 1	9	7	2 9	0 8 1	
0 8 6 2 4 9 0 6 0 4	1 7 3	5 9	8 7	6 4	6 1		2 6	0	0	3 2	0 8 1	
1 0 9 4 4 5 0 3 0 1	9 7 9	1 1 2		2 4	4 7		1 5	12	1 1	5 2	1 2 1	
1 0 9 4 4 5 0 3 0 2	3 3 2	3 3		2 4	4 7		4 0	1 0	0	5 2	1 2 1	
1 0 6 4 4 5 0 6 0 1	3 3 6	6 1 0 2		1 2	5 3		5 0	1 6	1	5 6	1 1 1	
1 0 7 5 9 9 0 0 0 1	2 1 0	3 3	1 0 0	5 5	16 8		3 2	1 5	0	3 8	1 1 0	
1 0 7 5 9 9 0 2 0 2	2 1 0	3 3	3 0 0	5 5	16 8		3 2	1 5	0	3 8	1 1 0	
1 0 7 5 9 9 0 3 0 1	2 0 2	1 2 2	1 3 2	2	13 5		5	0 10	0	3 1	4 5	
1 0 7 5 9 9 0 3 0 2	2 0 2	1 2 2	1 3 2	2	13 5		5	0 10	0	3 1	4 5	
1 2 6 4 2 0 0 0 1	1 0 4 7	6 7	7 1	3 0	1 1		1 5	1 2	0	3 2	1 1 0	
1 9 4 0 3 6 0 6 0 1	1 0 0 0	0	0	1 8	0 7		2 1 2	0	0	2 3	0 7	
	9 8 5 5 0 6	6 6		5 1 5	11 11		1 4 1 2	9 4		1 9 2 8	0 11	